



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

**Request For Bids For Construction Services
Two-Stage Bidding Process**

Stage II
Invitation to Bid

September 14, 2005

**HVAC SYSTEM UPGRADE
CEDAR CITY COURTS**

**ADMINISTRATIVE OFFICE OF
THE COURTS**

DFCM Project No. 05017150

WHW Engineering

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov> or are available upon request from DFCM:

DFCM General Conditions dated May 25, 2005

DFCM Application and Certificate for Payment dated May 25, 2005

Technical Specifications:

Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>

INVITATION TO BID

**ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I
ARE ALLOWED TO BID ON THIS PROJECT**

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting bids for the construction of the following project:

HVAC SYSTEM UPGRADE – CEDAR CITY COURTS
ADMINISTRATIVE OFFICE OF THE COURTS – CEDAR CITY, UTAH
DFCM PROJECT NO. 05017150

Removal and replacement of eight AHUs and addition of two new rooftop units. Construction cost estimate: \$160,000.00

<u>Company</u>	<u>Contact</u>	<u>Fax</u>
KHI Mechanical	Jeff Brown	801-972-2685
SR Mechanical	Chris Roberts	435-529-7851

The bid documents will be available at 10:00 AM on Wednesday, September 14, 2005 in electronic format from DFCM at 4110 State Office Building, Salt Lake City, Utah 84114, telephone (801) 538-3018 and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Jeff Reddoor, Project Manager, DFCM, at (801) 971-9830. No others are to be contacted regarding this project.

A **MANDATORY** pre-bid meeting and site visit will be held at 10:00 AM on Friday, September 16, 2005 at 40 North 100 East, Cedar City, Utah. All short listed prime contractors wishing to bid on this project must attend this meeting.

Bids must be submitted by 3:00 PM on Tuesday, September 27, 2005 to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. Note: Bids must be received at 4110 State Office Building by the specified time. The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction & Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of the State.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
MARLA WORKMAN, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114

STAGE II BIDDING PROCESS

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

1. Invitational Bid Procedures

Invitation to Bid: DFCM will notify each short-listed firm via e-mail and/or fax when a project is ready for construction services.

Bid Documents: Bidding documents including plans and specifications (if applicable) may be obtained by accessing DFCM's web page at <http://dfcm.utah.gov> or at DFCM's office 4110 State Office Building, Salt Lake City, Utah 84114.

Mandatory Pre-Bid Site Meeting: If required, the schedule contained in this document will indicate the date, time, and place of the mandatory pre-bid site meeting. At this meeting, contractors will receive additional instructions about the project and have an opportunity to ask questions about project details. If a firm fails to attend a pre-bid site meeting labeled "Mandatory" they will not be allowed to bid on the project.

Written Questions: The schedule contained in this document will indicate the deadline for submitting questions in writing to the DFCM Representative pertaining to this project.

Final Addendum: The schedule contained in this document will indicate the deadline for DFCM issuing the final addendum clarifying questions and changes to the scope of work. Contractors are responsible for obtaining and responding to information contained in the addenda.

Submitting Bids: Bids must be submitted to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114 by the deadline indicated on the schedule contained in this document. Bids submitted after the deadline will not be accepted. Bids will be opened at DFCM on the date, time, and place indicated on the schedule. (Additional information pertaining to bidding is contained later in this document). It is your responsibility to allow for the time needed to park on Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

Subcontractors List: The firm selected for the project must submit a list of all subcontractors by the deadline indicated on the schedule contained in this document. (Additional information pertaining to subcontractor lists is contained later in this document)

2. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Notice to Contractors.

3. **Bids**

Before submitting a bid, each bidder shall carefully examine the Contract Documents; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Notice to Contractor's prior to the published deadline for the submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a bid bond form other than the DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **Note: A cashier's check cannot be used as a substitute for a bid bond.**

4. **Contract and Bond**

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the Contract Sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for Subcontractors will be specified in the Supplementary General Conditions.

5. **Listing of Subcontractors**

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these Contract Documents. The subcontractors list shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contract for a period of up to three years.

6. **Interpretation of Drawings and Specifications**

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Representative a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by Addenda duly issued and a copy of such Addenda will be mailed or delivered to each person or entity receiving a set of documents. Neither DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

7. **Addenda**

Any Addenda issued during the time of bidding shall become part of the Contract Documents made available to the bidders for the preparation of the bid, shall be covered in the bid, and shall be made a part of the Contract.

8. **Award of Contract**

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. The DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

9. **DFCM Contractor Performance Rating**

DFCM will evaluate the performance of the Contractor. This evaluation may include comments from the User. The Contractor will have an opportunity to review and comment on the evaluation. Evaluations, including the Contractor's comments, may be considered in future selection in the evaluation of the Contractor's past performance.

10. **Licensure**

The Contractor shall comply with and require all of its Subcontractors to comply with the license laws as required by the State of Utah.

11. **Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

12. **Time is of the Essence**

The completion deadline for this project is **November 30, 2005**. Failure to meet the completion deadline may result in a poor performance rating from DFCM which may have a negative impact on your firm's ability to obtain future work with the state of Utah and may also result in liquidated damages being assessed. Time is of the essence in regard to all the requirements of the Contract Documents.

13. **Withdrawal of Bids**

Bids may be withdrawn on written request received from bidders within 24 hours after the bid opening if the contractor has made an error in preparing the bid.

14. **Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed

the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued Addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

15. **Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by the DFCM to any concern of financial responsibility of the Contractor, Subcontractor or Sub-subcontractor.

16. **Debarment.**

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by the DFCM as part of the requirements for award of the Project.



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

PROJECT SCHEDULE
Stage II = Two-Stage Bidding Process

PROJECT NAME: HVAC SYSTEM UPGRADE – CEDAR CITY COURTS ADMINISTRATIVE OFFICE OF THE COURTS – CEDAR CITY, UTAH				
DFCM PROJECT NO.: 05017150				
Event	Day	Date	Time	Place
Stage II Bidding Documents Available	Wednesday	September 14, 2005	10:00 AM	DFCM, 4110 State Office Bldg, SLC, UT and DFCM web site *
Mandatory Pre-bid Site Meeting	Friday	September 16, 2005	10:00 AM	Cedar City Courts 40 North 100 East Cedar City, UT
Last Day to Submit Questions	Tuesday	September 20, 2005	4:00 PM	DFCM, 4110 State Office Bldg, SLC, UT
Final Addendum Issued	Friday	September 23, 2005	4:00 PM	DFCM, 4110 State Office Bldg, SLC, UT or DFCM web site*
Prime Contractors Turn in Bid and Bid Bond / Bid Opening in DFCM Conference Room	Tuesday	September 27, 2005	3:00 PM	DFCM, 4110 State Office Bldg, SLC, UT
Subcontractors List Due	Wednesday	September 28, 2005	3:00 PM	DFCM, 4110 State Office Bldg, SLC, UT
Project Completion Date	Wednesday	November 30, 2005		

*** DFCM's web site address is <http://dfcm.utah.gov>**

**Division of Facilities Construction and Management****BID FORM**

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the Request for Bids for the **HVAC SYSTEM UPGRADE – CEDAR CITY COURTS – ADMINISTRATIVE OFFICE OF THE COURTS – CEDAR CITY, UTAH DFCM PROJECT NO. 05017150** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____) (In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **November 30, 2005** after receipt of the Notice to Proceed, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$700.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

BID FORM
PAGE NO. 2

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within time set forth.

Type of Organization: _____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

Respectfully submitted,

Name of Bidder

ADDRESS:

Authorized Signature

BID BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of \$ _____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____.

Principal's name and address (if other than a corporation):

By: _____

Title: _____

Principal's name and address (if a corporation):

By: _____

Title: _____
(Affix Corporate Seal)

Surety's name and address:

STATE OF _____)
COUNTY OF _____) ss.

By: _____
Attorney-in-Fact (Affix Corporate Seal)

On this ____ day of _____, 20_____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My Commission Expires: _____

Resides at: _____

Agency: _____
Agent: _____
Address: _____
Phone: _____

NOTARY PUBLIC

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

**Division of Facilities Construction and Management****INSTRUCTION AND SUBCONTRACTORS LIST FORM**

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER \$500,000 - ALL SUBS \$20,000 OR OVER MUST BE LISTED
PROJECTS \$500,000 OR MORE - ALL SUBS \$35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM
Page No. 2

GROUND FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	\$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

**PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS
SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.**

**Division of Facilities Construction and Management****SUBCONTRACTORS LIST****PROJECT TITLE:** _____**Caution:** You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____

SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality

April 20, 1999

**GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A
DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7**

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.
2. Address or location of your operation or construction site.
3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.
4. Lengths of the project, if temporary (time period).
5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.
6. Type of material processed or disturbed.
7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.
9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).
10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).
2. List type of equipment generating the fugitive dust.
3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.
4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads “on” and “off” property.
5. Vehicle miles travels on unpaved roads associated with the activity (average speed).
6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)
7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.
2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).
3. Method of application of dust suppressant.
4. Frequency of application of dust suppressant.
5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).
6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place “off” property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the source must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.
2. Time and duration of dust episode.
3. Meteorological conditions during the dust episode.
4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.
5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the source's dust control plan.
6. Reasons for failing to control dust from the dust generating activity or equipment.
7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.
8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary	Phone: (801) 536-4000
Utah Air Quality Board	FAX: (801) 536-4099
POB 144820	
15 North 1950 West	
Salt Lake City, Utah 84114-4820	

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____
_____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____
_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ DOLLARS AND NO CENTS (\$_____.00), which is the base bid, and which sum also includes the cost of a 100%

CONTRACTOR'S AGREEMENT
PAGE NO. 2

Performance Bond and a 100% Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete within _____ (____) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of \$_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the

CONTRACTOR'S AGREEMENT
PAGE NO. 3

Contractor requests payment and agrees to safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

CONTRACTOR'S AGREEMENT
PAGE NO. 5

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

Signature Date

Title: _____

State of _____)
County of _____)

Please type/print name clearly

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

(SEAL)

Notary Public

My Commission Expires _____

APPROVED AS TO AVAILABILITY
OF FUNDS:

Financial Manager, Date
Division of Facilities Construction
and Management

**DIVISION OF FACILITIES
CONSTRUCTION AND MANAGEMENT**

Manager - Date
Capital _____

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

Division of Finance Date

PERFORMANCE BOND
(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of _____ DOLLARS (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ Dollars (\$ _____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____
(Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____
Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____

Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General
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PAYMENT BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ Dollars (\$ _____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____ Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____

Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

**Division of Facilities Construction and Management****CHANGE ORDER # _____**

CONTRACTOR: _____

AGENCY OR INSTITUTION: _____

PROJECT NAME: _____

PROJECT NUMBER: _____

CONTRACT NUMBER: _____

ARCHITECT: _____

DATE: _____

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor: _____

Date

Architect/Engineer: _____

Date

Agency or Institution: _____

Date

DFCM: _____

Date

Funding Verification: _____

Date

**CERTIFICATE OF SUBSTANTIAL COMPLETION**

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

A list of items to be completed or corrected is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof.

The Contractor shall complete or correct the Work on the list of items appended hereto within _____ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$_____.

CONTRACTOR (include name of firm) by: _____ DATE

A/E by: _____ DATE

USING INSTITUTION OR AGENCY by: _____ DATE

DFCM by: _____ DATE

cc: Parties Noted
DFCM, Director

HVAC SYSTEM UPGRADE CEDAR CITY COURTS CEDAR CITY, UTAH

DFCM PROJECT #05017150



State of Utah—Department of Administrative Services

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

4110 State Office Building / Salt Lake City, Utah 84114 / 538-3018

SPECIFICATIONS

PREPARED BY

**WHW ENGINEERING INC.
1354 EAST 3300 SOUTH, SUITE 200
SALT LAKE CITY, UTAH 84106
PHONE: (801) 466-4021
FAX: (801) 466-8536**

AUGUST 2005

WHW Engineering Project # 05013

DIVISION 1 - GENERAL REQUIREMENTS

01100 SUMMARY
01732 SELECTIVE DEMOLITION
01770 CLOSEOUT PROCEDURES
01781 PROJECT RECORD DOCUMENTS
01782 OPERATION AND MAINTENANCE DATA

DIVISION 15 - MECHANICAL SPECIFICATION

15000 GENERAL

15050 BASIC MATERIALS & METHODS

15050 BASIC MATERIALS AND METHODS

15055 MOTORS
15081 DUCT INSULATION

15100 BUILDING SERVICES PIPING

15183 REFRIGERANT PIPING
15196 NATURAL GAS PIPING
15530 FURNACES
15733 ROOFTOP REPLACEMENT AIR UNITS
15816 RECTANGULAR STEEL DUCT
15822 DUCT LINER

15900 INSTRUMENTATION AND CONTROLS

15910 CONTROLS
15960 AIR SYSTEM TEST AND BALANCE

DIVISION 16 - ELECTRICAL WORK

16000 GENERAL PROVISIONS, ELECTRICAL
16110 RACEWAYS
16120 CONDUCTORS
16130 ELECTRICAL BOXES
16190 SUPPORTING DEVICES
16410 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

DIVISION 1
GENERAL REQUIREMENTS

01100 SUMMARY
01732 SELECTIVE DEMOLITION
01770 CLOSEOUT PROCEDURES
01781 PROJECT RECORD DOCUMENTS
01782 OPERATION AND MAINTENANCE DATA

SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Use of premises.
 - 3. Owner's occupancy requirements.
 - 4. Work restrictions.
 - 5. Specification formats and conventions.
- B. Related Sections include the following:
 - 1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Cedar City Courts Building Hall of Justice DFCM # 05017150
 - 1. Project Location: Cedar City, Utah.
- B. Owner: State Justice Department
 - 1. Owner's Representative: DFCM
- C. Architect: WHW Engineering
- D. The Work consists of the following:
 - 1. The Work includes replacing all furnaces, condensing units, one roof top unit and providing three new roof top units and new controls.

1.4 USE OF PREMISES

- A. General: Contractor shall have limited use of interior space for construction operations. Work in the two courts shall be coordinated with the courts. Work In the

courts is not permitted unless permission is given. Work on the roof and in the equipment room is not limited unless it shuts down the courts.

1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
 2. Entrances: Keep entrances serving premises clear and available to Owner, Owner's employees, and the public.
- B. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations. See paragraph 1.4 – B.

1.6 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, except otherwise indicated.
1. Weekend Hours: As approved by the courts.
 2. Early Morning Hours: As approved by the courts.
 3. Hours for Utility Shutdowns: 72 hours notice. See paragraph 1.5 – A – 2.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.8 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of all furnaces, one roof top unit and all roof mounted condensing units.
 - 2. Existing controls shall be removed. Coordinate removal with ATC contractor.
 - 3. Coordinate removal of ductwork with the new ductwork and connections to the existing ductwork.
 - 4. Salvage of existing new 10 ton roof mounted air cooled condensing unit. Return this unit to owner.
- B. Related Sections include the following:
 - 1. Division 1 Section "Summary" for use of premises and Owner-occupancy requirements.
 - 2. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
 - 3. Division 1 Section "Construction Waste Management" for disposal of demolished materials.
 - 4. Division 1 Section "Cutting and Patching" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.

1.5 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
 - 1. Comply with requirements specified in Division 1 Section "Summary."
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished at the time of their removal.

3.3 PREPARATION

- A. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to building and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Maintain adequate ventilation.
 - 2. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 3. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:
 - 1. Clean salvaged items (10 Ton air cooled condensing units).
 - 2. Store items in a secure area until delivery to Owner.
 - 3. Transport items to Owner's storage area designated by Owner.
 - 4. Protect items from damage during transport and storage.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be salvaged or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
 - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. All divisions of the specifications for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints.
 - 2. Number of Copies: Submit Record Drawings as follows:
 - a. Final Submittal: Submit one set of marked-up Record Prints. Print each Drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of prints of the Contract Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Revisions to routing of piping and conduits.
 - d. Revisions to electrical circuitry.
 - e. Actual equipment locations.
 - f. Duct size and routing.
 - g. Changes made by Change Order or Construction Change Directive.
 - h. Changes made following Engineer's written orders.
 - i. Details not on the original Contract Drawings.
 - j. Field records for variable and concealed conditions.
3. Mark the Contract Drawings completely and accurately.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders and Record Drawings where applicable.

2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

END OF SECTION 01781

SECTION 01782 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Maintenance manuals for the care and maintenance of systems and equipment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
 - 2. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 3. All divisions of the specifications for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

- A. Final Submittal: Submit four copies of O&M manual in final form at least 2 days before final inspection. Engineer will return copy with comments within 10 days after final inspection.
 - 1. Correct or modify each manual to comply with Engineer's comments. Submit 4 copies of each corrected manual within 10 days of receipt of Engineer's comments.

1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each operation and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name, address, and telephone number of Contractor.

6. Name and address of Architect.
 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.

10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- D. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

**DIVISION 15
MECHANICAL SPECIFICATION**

15000 GENERAL

15050 BASIC MATERIALS & METHODS

15050 BASIC MATERIALS AND METHODS

15055 MOTORS

15081 DUCT INSULATION

15100 BUILDING SERVICES PIPING

15183 REFRIGERANT PIPING

15196 NATURAL GAS PIPING

15530 FURNACES

15733 ROOFTOP REPLACEMENT AIR UNITS

15816 RECTANGULAR STEEL DUCT

15822 DUCT LINER

15900 INSTRUMENTATION AND CONTROLS

15910 CONTROLS

15960 AIR SYSTEM TEST AND BALANCE

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
 - 5. Mechanical demolition.
 - 6. Equipment installation requirements common to equipment sections.
 - 7. Painting and finishing.
 - 8. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PVC: Polyvinyl chloride plastic.

1.4 QUALITY ASSURANCE

- A. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- D. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
 - h. Prior Approved Equal.
- D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
 - 1. Available Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
 - c. Prior Approved Equal.

2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material until new connection.
 - 4. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Drawings do not show every offset, or bend that may be required. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install escutcheons for penetrations of walls, ceilings, and floors where indicated on drawings and where penetrating will be visible to public.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
 - H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

END OF SECTION 15050

SECTION 15055 - MOTORS

PART 1 - GENERAL

1.1 SCOPE:

- A. Includes -
 - 1. All motors used in Division 15.

1.2 RELATED SECTIONS:

- A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 REQUIREMENTS:

- A. Motors shall be quiet in operation and speed shall not exceed 1800 rpm unless otherwise noted.
- B. All motors shall be domestic made motors regardless of size.
- C. All motors for equipment specified or provided under this Section of work shall be furnished, handled and set in place by Contractor.
- D. All motors shall be designed, wound, and nameplated for the voltage shown and the service indicated on the drawings. All motors operating outdoors shall be fully weather and waterproof.
- E. All motors shall be re-rated or adjusted for service in job site altitude atmosphere.
- F. All motors shall be copper wound and have overload protection on all legs.
- G. Motors with ball bearings shall comply with noise level standards as set by NEMA Standard MG1-12.47. Motor bearings shall be rated at 100,000 hours B-10 bearing life. All motors shall be ball bearing type.
- H. After all motor driven equipment is installed and in proper operating condition, Contractor, jointly with the Electrical Contractor, shall make load, speed and rotation tests. Any motor which fails to comply with requirements of the specifications or to operate satisfactorily, shall be adjusted or replaced as directed.

PART 3 - EXECUTION

(Not Used)

END OF SECTION 15055

SECTION 15081 - DUCT INSULATION

PART 1 - GENERAL

1.1 SCOPE:

- A. Includes -
 - 1. Insulating of concealed round above grade supply air ducts that are not lined. All ductwork routed outside of building insulation envelope.
 - 2. Insulation shall have surface burning characteristics as determined by ASTM E84 with a flame spread rating of 25 and a smoke developed of 50.
- B. Related Work specified Elsewhere -
 - 1. Acoustical insulation inside air ducts is specified in Section 15822.

PART 2 - PRODUCTS

2.1 INSULATION:

- A. 1-1/2 inch thick fiberglass with aluminum foil scrim kraft facing and have a density of one lb/cu ft.
- B. Approved Manufacturers:
 - 1. Johns-Manville Microlite FSK
 - 2. CSG Type IV standard duct insulation
 - 3. Owens-Corning FRK-25
 - 4. Knauf (Duct Wrap FSK)

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install duct wrap in accordance with Manufacturer's recommendations.
- B. Do not compress insulation except in areas of structural interference.
- C. Joints shall be completely sealed.

END OF SECTION 15081

SECTION 15183 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications. Refrigerant piping shall be routed between the new roof mounted condensing units and the new furnaces.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-22:
 - 1. Suction Lines for Air-Conditioning Applications: 185 psig (1276 kPa).
 - 2. Liquid Lines: 325 psig (2241 kPa).
- B. Line Test Pressure for Refrigerant R-134a:
 - 1. Suction Lines for Air-Conditioning Applications: 115 psig (793 kPa).
 - 2. Liquid Lines: 225 psig (1551 kPa).
- C. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
 - 2. Liquid Lines: 535 psig (3689 kPa).

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.6 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B)
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
 - 5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 3. Operator: Rising stem and hand wheel.
 - 4. Seat: Nylon.
 - 5. End Connections: Socket, union, or flanged.
 - 6. Working Pressure Rating: 500 psig (3450 kPa).
 - 7. Maximum Operating Temperature: 275 deg F (135 deg C).
- B. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Copper spring.

5. Working Pressure Rating: 500 psig (3450 kPa).
- C. Safety Relief Valves: Provided and installed in units by equipment manufacturers.
- D. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. End Connections: Socket, flare, or threaded union.
- E. Moisture/Liquid Indicators:
1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in ppm.
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
- F. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina.
 4. End Connections: Socket.
 5. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 6. Maximum Pressure Loss: 2 psig (14 kPa).
 7. Rated Flow: As scheduled on the drawings.
 8. Working Pressure Rating: 500 psig (3450 kPa).
 9. Maximum Operating Temperature: 240 deg F (116 deg C).
- G. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina or charcoal.
 4. End Connections: Socket.
 5. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 6. Maximum Pressure Loss: 2 psig (14 kPa).
 7. Rated Flow: As scheduled on the drawings.
 8. Working Pressure Rating: 500 psig (3450 kPa).
 9. Maximum Operating Temperature: 240 deg F (116 deg C).
- H. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 2. Comply with UL 207; listed and labeled by an NRTL.
 3. Body: Welded steel with corrosion-resistant coating.
 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
 5. End Connections: Socket or threaded.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 275 deg F (135 deg C).
- I. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
 2. End Connections: Socket or threaded.
 3. Working Pressure Rating: 500 psig (3450 kPa).
 4. Maximum Operating Temperature: 275 deg F (135 deg C).

2.3 REFRIGERANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
 2. DuPont Company; Fluorochemicals Div.
 3. Honeywell, Inc.; Genetron Refrigerants.
 4. INEOS Fluor Americas LLC.
- B. ASHRAE 34, R-22: Monochlorodifluoromethane.
- C. ASHRAE 34, R-134a: Tetrafluoroethane.
- D. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.
- E. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-22

- A. Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air-Conditioning Applications: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
- B. Liquid Lines: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Liquid Lines: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
1. NPS 1-1/2 (DN 40) and Smaller: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.

- D. Safety-Relief-Valve Discharge Piping: Copper, Type L hard, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-134a

- A. Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air-Conditioning Applications: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
- B. Liquid Lines:
 - 1. NPS 1-1/2 (DN 40) and Smaller: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Safety-Relief-Valve Discharge Piping: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.3 PIPING APPLICATIONS FOR REFRIGERANT R-407C

- A. Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air-Conditioning Applications: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
- B. Liquid Lines:
 - 1. NPS 1 1/2" (DN 40) and Smaller: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Safety-Relief-Valve Discharge Piping:
 - 1. NPS 1 1/2" (DN 40) and Smaller: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.

3.4 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: NPS 2 (DN 50) and Smaller for Conventional Air-Conditioning Applications: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
- B. Liquid Lines:
 - 1. NPS 5/8 (DN 18) and Smaller: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed joints.
 - 2. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), hard drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Safety-Relief-Valve Discharge Piping:

1. NPS 5/8 (DN 18) and Smaller: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 (DN 32) and Smaller: Copper, Type L (B) hard, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

3.5 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor, if not an integral part of equipment.
- B. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- C. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- D. Install a full-sized, three-valve bypass around filter dryers.
- E. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 1. Install valve so diaphragm case is warmer than bulb.
 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line or in any vertical piping.
 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- F. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- G. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- H. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 1. Compressor.
- I. Install filter dryers in liquid line between compressor and thermostatic expansion valve.
- J. Install receivers sized to accommodate pump-down charge.
- K. Install flexible connectors at compressors.

3.6 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping adjacent to machines to allow service and maintenance.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- K. Slope refrigerant piping as follows:
 - 1. Install horizontal suction lines with a uniform slope downward to compressor.
 - 2. Install traps and double risers to entrain oil in vertical runs.
 - 3. Liquid lines may be installed level.
- L. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- M. Install pipe sleeves at penetrations in exterior walls seal air and water tight.
- N. Seal penetrations through fire and smoke barriers.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- P. Seal pipe penetrations through exterior walls.
- Q. Identify refrigerant piping and valves according to Division 15 Section "Mechanical Identification."

3.7 PIPE JOINT CONSTRUCTION

- A. Ream ends of tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing to prevent scale formation. If this is not done contractor will repeat process.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.8 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 15 Section "Hangers and Supports."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
 - 2. Spring hangers to support vertical runs.
 - 3. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 - 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 - 3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
 - 4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
 - 5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
 - 6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.10 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
 - 4. Charge system with a new filter-dryer core in charging line.

3.11 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.

5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 15183

SECTION 15196 NATURAL GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To
 - 1. Furnish and install gas piping and fittings within building and from building to meter including connection to meter as described in Contract Documents.
- B. Related Sections
 - 1. Section 15010 - General Mechanical Requirements

1.2 REFERENCES

- A. American Society For Testing And Materials
 - 1. ASTM A 53-96, 'Standard Specification for Pipe, Steel and Hot-Dipped, Zinc-Coated, Welded and Seamless'
 - 2. ASTM A 234-96b, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature Service'
 - 3. ASTM D 2513-96a, 'Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings'

1.3 QUALITY ASSURANCE

- A. Qualifications
 - 1. Welders shall be certified and bear evidence of certification 30 days before commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority. See Section 15101

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

- A. Valves
 - 1. 125 psi bronze body ball valve, UL listed
 - 2. Approved Manufacturers & Models -
 - a. ConBraCo - 'Apollo' series 80-100
 - b. Jenkins - FIG-30-A
 - c. Jomar - Model T-204
 - d. McDonald - 3410
 - e. Milwaukee - BCI-100T (with tee handle)
 - f. PGL Corp - 'Red Cap' gas ball valve
 - g. Watts - Model B-6000-UL
- B. Gas Regulators
 - 1. Gas regulators of capacity required to reduce gas pressure from 1 to 2 PSI to 4 oz.

2. Regulators shall be of self ventilating type suitable for interior installation and in space venting where indicated on drawings.
3. Units shall be approved by Questar Gas for use intended.
4. Approved Manufacturers
 - a. Fisher
 - b. Rego
 - c. Other manufacturers approved by Questar Gas

2.2 COMPONENTS

- A. Above-Ground Pipe & Fittings - Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of ASTM A 53. Welded forged steel fittings meeting requirements of ASTM A 234 or standard weight malleable iron screwed.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Steel pipe installed through air plenums, in walls, and pipes 2-1/2 inches and larger shall have welded fittings and joints. Other steel pipe may have screwed or welded fittings.
- B. Install gas cocks on lines serving gas-fired equipment adjacent to equipment, on outside of equipment cabinet, and easily accessible.
- C. Install 6 inch long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.
- D. Use fittings for changes of direction in pipe and for branch runouts.
- E. Install earthquake valve on downstream side of meter prior to pipe entering the building.

3.2 FIELD QUALITY CONTROL

- A. Site Tests - Before pipes are buried or concealed from view, test systems in Engineer's presence at 60 psig for 4 hours and show no drop in pressure.

END OF SECTION 15196

SECTION 15530 - FURNACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Gas-fired, condensing furnaces and accessories complete with controls.
 - 2. Air filters.
 - 3. Ventilation heat exchangers.
 - 4. Refrigeration components.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
 - 1. Warranty Period, Commencing on Date of Substantial Completion:
 - a. Furnace Heat Exchanger: 10 years.
 - b. Integrated Ignition and Blower Control Circuit Board: Five years.
 - c. Draft-Inducer Motor: Five years.
 - d. Evaporator Coils: Five years.

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Disposable Air Filters: Furnish two complete sets.

PART 2 - PRODUCTS

2.1 GAS-FIRED FURNACES, CONDENSING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 1. Carrier Corporation; Div. of United Technologies Corp.
 2. Bryant Heating & Cooling Systems; Div. of United Technologies Corp.
 3. Trane.
 4. York International Corp.; a division of Unitary Products Group.
- C. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
- D. Cabinet: Steel.
 1. Cabinet interior around heat exchanger shall be factory-installed insulation.
 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 3. Factory paint external cabinets in manufacturer's standard color.
- E. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
 1. Fan Motors: Comply with requirements in Division 15 Section "Motors."
 2. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
 3. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
- F. Type of Gas: Natural.
- G. AFUE: 95 percent.
- H. Heat Exchanger:
 1. Primary: Stainless steel.
 2. Secondary: Stainless steel.
- I. Burner:
 1. Gas Valve: 100 percent safety modulating main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.

2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

J. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

K. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

L. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.

M. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof.
2. Plastic Vent Materials.
 - a. CPVC Plastic, Schedule 40 Pipe: ASTM F 441/F 441M.
 - 1) CPVC Plastic, Schedule 40 Fittings: ASTM F 438, socket type.
 - 2) CPVC Solvent Cement: ASTM F 493.
 - b. PVC Plastic, Schedule 40 Pipe: ASTM D 1785.
 - 1) PVC Plastic, Schedule 40 Fittings: ASTM D 2466, socket type.
 - 2) PVC Solvent Cement: ASTM D 2564.

N. Capacities and Characteristics:

1. Airflow Configuration: Upflow.
2. Gas: Natural.
3. Capacities: See schedule on drawings.
4. Fan: See schedule on drawings.
5. Furnace Electrical Connection: See schedule on drawings.

2.2 AIR FILTERS

- A. Disposable Filters: 1-inch- (25-mm-) thick, disposable, fiberglass type in sheet metal frame.

2.3 VENTILATION AIR HEAT EXCHANGER

- A. Cabinet: Steel, with factory-installed interior insulation and manufacturer's standard factory finish. Fabricate with space for piping and electrical conduits.

- B. Heat-Recovery Device: Fixed-plate, polypropylene copolymer (high-density plastic) heat-exchanger plates evenly spaced and sealed and arranged for counter airflow.
- C. Supply and Exhaust Fans: Forward curved centrifugal with direct drive. Motors comply with requirements in Division 15 Section "Motors."
- D. Filters: 1-inch- (25-mm-) thick disposable type, in galvanized-steel frame, mounted upstream of unit in both supply and exhaust airstreams.
- E. Wiring: Wire motors and controls so only external connections are required during installation.

2.4 REFRIGERATION COMPONENTS

- A. General Refrigeration Component Requirements:
 - 1. Refrigeration coils and specialties shall be designed to operate with HCFC-free refrigerants.
 - 2. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
 - 3. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Standard for Buildings except Low-Rise Residential Buildings."
- B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet.
 - 1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.
- C. Refrigerant Piping: Comply with requirements in Division 15 Section "Refrigerant Piping."
- D. Air-Cooled, Compressor-Condenser Unit:
 - 1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - 2. Compressor: Hermetically sealed reciprocating type.
 - a. Crankcase heater.
 - b. Vibration isolation mounts for compressor.
 - c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - e. Refrigerant Charge: R-22, R-407C, R-410A, and 134a.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 35 deg F (7 deg C).
7. Mounting Base: Polyethylene.

E. Capacities and Characteristics:

1. Refrigerant Coil: See schedule on drawings.
2. Compressor-Condenser Unit: See schedule on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
 1. Anchor furnace to substrate to resist code-required seismic acceleration.
- C. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- D. Install roof-mounted, compressor-condenser components on 4x4 Redwood rails.
- E. Install roof-mounted, compressor-condenser components on polyethylene mounting base between unit and redwood rails. Anchor units to rails with removable, cadmium-plated fasteners.

3.3 CONNECTIONS

- A. Gas piping installation requirements are specified in Division 15 Section "Fuel Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union, pressure regulator, and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
 - 1. Ream ends of pipes and tubes and remove burrs.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - c. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. Slope pipe vent back to furnace or to outside terminal.
- D. Connect ducts to furnace with flexible connector. Comply with requirements in Division 15 Section "Duct Accessories."
- E. Connect refrigerant piping to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.
 - 1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
 - 2. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Comply with requirements in Division 15 Section "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical test and visual and mechanical inspection.

2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.5 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
1. Inspect for physical damage to unit casings.
 2. Verify that access doors move freely and are weathertight.
 3. Clean units and inspect for construction debris.
 4. Verify that all bolts and screws are tight.
 5. Adjust vibration isolation and flexible connections.
 6. Verify that controls are connected and operational.
- B. Adjust fan belts to proper alignment and tension.
- C. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.
- D. Measure and record airflows.
- E. Verify proper operation of capacity control device.
- F. After startup and performance test, lubricate bearings and adjust belt tension.

3.6 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including dampers, and relays, to provide optimum heating performance and system efficiency.

3.7 CLEANING

- A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

- B. Install new filters in each furnace within 14 days after Substantial Completion.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 15530

SECTION 15733 - ROOFTOP UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes three cooling and heating rooftop units and the replacement of one existing roof top unit.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawing schedules capacity and requirements of new rooftop units and are based on the specific system indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

- A. Coordinate size, installation, and structural capacity of new roof curbs, and one adapter curb for existing unit to be replaced, and roof penetrations.
- B. Coordinate size, location, and installation of rooftop unit manufacturer's roof curbs and equipment supports with roof manufacturer. Roof manufacturer shall install roofing material flashings around curbs to maintain roofing warranties.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier.
 2. Aeon.
 3. Trane.
 4. York.
 5. Bryant.

2.2 CABINET

- A. Construction: Double wall.
- B. Exterior Casing: Galvanized steel with baked-enamel paint finish with lifting lugs and knockouts for electrical and piping connections.
- C. Interior Casing: Stainless steel.
- D. Base Rails: Galvanized steel rails for mounting on roof curb.
- E. Service Doors: Hinged access doors with neoprene gaskets.
- F. Internal Insulation: Fibrous-glass duct lining complying with ASTM C 1071, Type II.
1. Thickness: 1 inch (25 mm).
 2. Insulation Adhesive: Comply with ASTM C 916, Type I.
 3. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.
- G. Condensate Drain Pans: Formed sections of stainless-steel sheet designed for self-drainage. Fabricate pans with slopes to preclude buildup of microbial slime.

2.3 SUPPLY-AIR FAN

- A. Fan: Forward-curved centrifugal; statically and dynamically balanced, coated steel, mounted on solid-steel shaft with self-aligning, permanently lubricated ball bearings.
- B. Motor: Totally enclosed, single-speed motor.

- C. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 1.4 service factor.
- D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with spring isolators.

2.4 REFRIGERATION SYSTEM

- A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- B. Compressors: Reciprocating compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.
- C. EER: As scheduled in Drawings.
- D. Refrigerant: R-22, R-407C, R-410A, and R-134.
- E. Refrigeration System Specialties:
 - 1. Expansion valve with replaceable thermostatic element.
 - 2. Refrigerant dryer.
 - 3. High-pressure switch.
 - 4. Low-pressure switch.
 - 5. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
 - 6. Brass service valves installed in discharge and liquid lines.
 - 7. Operating charge of refrigerant.
- F. Refrigerant Coils: Evaporator and condenser coils shall be designed, tested, fabricated, and rated according to ARI 410 and ASHRAE 33. Coils shall be leak tested under water with air at 315 psig (2170 kPa).
 - 1. Tubes: Copper.
 - 2. Fins: Aluminum or Copper with minimum fin spacing of 0.071 inch (1.81 mm).
 - 3. Fin and Tube Joint: Mechanical bond.
 - 4. Suction and Distributor: Seamless copper tube with brazed joints.
 - 5. Coating: Phenolic epoxy corrosion-protection coating on both coils.
 - 6. Source Quality Control: Test to 450 psig (3105 kPa), and to 300 psig (2070 kPa) underwater.
- G. Condenser Fan: Propeller type, directly driven by motor.
- H. Safety Controls:
 - 1. Compressor motor and outside-coil fan motor low ambient lockout.
 - 2. Overcurrent protection for compressor motor and outside-coil fan motors.

2.5 INDIRECT-FIRED GAS FURNACE

- A. Description: Factory assembled, piped, and wired; complying with NFPA 54, "National Fuel Gas Code," and ANSI Z21.47, "Gas-Fired Central Furnaces."
 - 1. AGA Approval: Designed and certified by and bearing label of AGA.
- B. Burners: Stainless steel with a minimum thermal efficiency of 80 percent.
 - 1. Fuel: Natural gas.
 - 2. Ignition: Electronically controlled electric spark with flame sensor.
 - 3. High-Altitude Model: For Project elevations more than 2000 feet (610 m) above sea level.
- C. Heat-Exchanger Drain Pan: Stainless steel.
- D. Venting: Gravity vented.
- E. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.
- F. Safety Controls:
 - 1. Gas Control Valve: Electronic modulating.
 - 2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.6 OUTDOOR-AIR INTAKE AND DAMPERS

- A. Dampers: Leakage rate, according to AMCA 500, shall not exceed 2 percent of air quantity at face velocity of 2000 fpm (10 m/s) through damper and pressure differential of 4-inch wg (1000 Pa).
- B. Damper Operators: Electric.
- C. Mixing Boxes: Parallel-blade, galvanized-steel dampers mechanically fastened to steel operating rod inside cabinet. Connect operating rods with common interconnecting linkages so dampers operate simultaneously.
- D. Outdoor-Air Intake Hoods: Galvanized steel, with bird screen and finish to match cabinet.
- E. Provide power exhausters as called out in drawings.

2.7 FILTERS

- A. Comply with NFPA 90A.
- B. Disposable Panel Filters: 2-inch- (50-mm-) thick, factory-fabricated, flat-panel-type, disposable air filters with holding frames.

1. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
2. Frame: Galvanized steel.

2.8 CONTROLS

- A. Control equipment and sequence of operation are specified in Division 15 Section "HVAC Instrumentation and Controls."
- B. Factory-wire connection for controls' power supply.
- C. Control devices, including sensors, transmitters, relays, switches, thermostats, humidistats, detectors, operators, actuators, and valves, shall be manufacturer's standard items to accomplish indicated control functions.
- D. Unit Controls: See Section 15910 for building automation
- E. Refrigeration System Controls:
 1. Unit-mounted enthalpy controller shall lock out refrigerant system when outdoor-air temperature is less than 60 deg F (15 deg C).
- F. Integral Smoke Alarm: Provide smoke detector in the supply and return air on units of 2000 CFM or larger.

2.9 MOTORS

- A. Comply with requirements in Division 15 Section "Motors."

2.10 ROOF CURB

- A. Roof curbs shall be constructed of galvanized steel. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit.
Options:
 1. Unit shall be provided with heavy duty, one piece vibration isolation curb. Each curb shall have the following features:
 - a. 1 g seismic restraint and 200 mph wind restraint.
 - b. Access ports for inspection and adjustment at each spring.
 - c. 4" deflection springs.
 - d. High frequency noise isolation.
 - e. Supply and return duct support hardware.
 - f. Galvanized steel curb with wood nailer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation of rooftop units.
- B. Examine roughing-in for ducts and electrical systems to verify actual locations of connections before equipment installation.
- C. Examine roof curbs and equipment supports for suitable conditions where rooftop units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install new roof curb on roof structure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure rooftop replacement unit on new curbs or adapter curbs and coordinate roof penetrations and flashing with roof construction.

3.3 CONNECTIONS

- A. Gas piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install gas piping adjacent to machine to allow service and maintenance.
 - 1. Gas Burner Connections: Comply with requirements in Division 15 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct Connections: Duct installation requirements are specified in Division 15 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to new rooftop units with flexible duct connectors. Flexible duct connectors are specified in Division 15 Section "Duct Accessories."
- D. Electrical Connections: Comply with requirements of unit manufacturer for power wiring.
- E. Ground equipment.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Inspect for visible damage to burner combustion chamber.
 - 2. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
 - 3. Inspect casing insulation for integrity, moisture content, and adhesion.
 - 4. Verify that clearances have been provided for servicing.
 - 5. Verify that controls are connected and operable.
 - 6. Verify that filters are installed.
 - 7. Clean outside coil and inspect for construction debris.
 - 8. Inspect operation of power vents.
 - 9. Purge gas line.
 - 10. Inspect and adjust vibration isolators and seismic restraints.
 - 11. Verify bearing lubrication.
 - 12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 13. Adjust fan belts to proper alignment and tension.
 - 14. Start unit.
 - 15. Start refrigeration system when outdoor-air temperature is within normal operating limits.
 - 16. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
 - 17. Operate unit for run-in period.
 - 18. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:
 - a. Measure gas pressure at manifold.
 - b. Measure combustion-air temperature at inlet to combustion chamber.
 - c. Measure flue-gas temperature at burner discharge.
 - d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - 19. Calibrate controls.
 - 20. Adjust and inspect high-temperature limits.
 - 21. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 - 22. Start refrigeration system and measure and record the following:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
 - 23. Verify operational sequence of controls.
 - 24. Measure and record the following airflows. Plot fan volumes on fan curve.

- a. Supply-air volume.
 - b. Return-air volume.
 - c. Outdoor-air intake volume.
- 25. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through outside coil or from outside coil to outdoor-air intake.
- 26. Verify operation of remote ATC. Inspect the following:
 - a. High-limit heat exchanger.
 - b. Alarms.
- C. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
- D. Remove and replace components that do not pass tests and inspections and retest as specified above.
- E. Prepare written report of the results of startup services.

3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop units. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 15733

SECTION 15816 - STEEL DUCTWORK

PART 1 - GENERAL

1.1 SCOPE -

- A. Includes -
 - 1. Furnish and install the ½" to 2" wg ductwork and related items specified below and shown on the Drawings.
 - 2. Ductwork shall be installed in strict accordance with SMACNA Standards (latest edition) for exterior installation.
- B. Related Work Specified Elsewhere -
 - 1. General Division 01 and Section 15010 and 15051 are a part of this Section.

PART 2 - PRODUCTS

2.1 DUCT MATERIAL -

- A. Fabricate of zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 527-80 with Type G coating.
- B. Use of aluminum or non-metal ducts is forbidden.

PART 3 - EXECUTION

3.1 DUCTS -

- A. Straight and smooth on inside with joints neatly finished unless otherwise directed.
- B. Duct panels through 48 inch dimension having acoustic duct liner need not be crossbroken or beaded.
- C. Brace and install ducts so they shall be free of vibration under all conditions of operation.
- D. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on drawings.
- E. Ducts shall be large enough to accommodate inside acoustic duct liner.
- F. Install internal ends of slip joints in direction of flow. Make joints air tight using mastic type duct sealer.
- G. Cover horizontal and longitudinal joints on all ducts with two layers of hardcast tape installed with hardcast HC-20 adhesive according to manufacturer's recommendations, or equivalent by Duro Dyne Corporation or H.B. Fuller Company.
- H. Install flexible inlet and outlet duct connections to terminal units, fan coils, air handlers and exhaust fans.
- I. Provide each duct take-off with an adjustable volume damper to balance that branch -
 - 1. Anchor dampers securely to duct.
 - 2. Install dampers in main ducts within insulation.

3. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.

3.2 AIR TURNS -

- A. Permanently installed, consisting of curved metal blades or vanes arranged to permit air to make abrupt turn without appreciable turbulence, in elbows of supply and above ground return ductwork.
- B. Air turns shall be quiet and free from vibration when system is in operation.

END OF SECTION 15816

SECTION 15822 - ACOUSTICAL DUCT LINER

PART 1 - GENERAL

1.1 SCOPE -

- A. Includes -
 - 1. Acoustical lining of all rectangular supply and return air ductwork -
- B. Insulation materials, adhesives, coatings, and other accessories shall have surface burning characteristics as determined by ASTM E 84 not to exceed 25 for flame spread and 50 for smoke developed. Flame proofing treatments subject to deterioration due to the effect of moisture or high humidity are not acceptable.

- 1.2** Duct dimensions shown on drawings are for inside of duct liner and does not include liner insulation.

1.3 RELATED SECTIONS -

- A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 DUCT LINER -

- A. One inch thick, 1-1/2 lb density fiberglass.
- B. Approved Manufacturers -
 - 1. CSG Ultralite OR Tough guard
 - 2. Johns-Manville Lina-Coustic
 - 3. OCF Aeroflex
 - 4. Knauf Type M

2.2 ADHESIVE -

- A. Approved water base products- Approved Products
 - 1. Cain - Hydrotak
 - 2. Design Polymeric - DP2501 or DP2502 (CMCL-2501)
 - 3. Duro Dyne - WSA
 - 4. Hardcast - IA-901
 - 5. Kingco - 10-568
 - 6. Miracle - PF-101
 - 7. Mon-Eco - 22-67
 - 8. Polymer Adhesive - Glasstack #35
 - 9. Techno Adhesive - 133
 - 10. United McGill - Uni-tack

2.3 MECHANICAL FASTENERS -

- A. Conform to Mechanical Fastener Standard MF-19/1.
- B. Pins that attach to ductwork with adhesives are not allowed.

- C. Approved Manufacturers -
 - 1. Duro Dyne
 - 2. Omark dished head "Insul-Pins"
 - 3. Grip nails may be used if each nail is installed by "Grip Nail Air Hammer" or by "Automatic Fastener Equipment" in accordance with Manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with a continuous 100% coat of adhesive and with mechanical fasteners spaced as shown on drawings. Pin all duct liner.
- B. Accurately cut liner and thoroughly coat exposed edges of duct liner, including diffuser drop cut-outs with adhesive to seal fibers. Butt joints tightly. Top and bottom sections of insulation shall overlap sides.
- C. Keep duct liner clean and free from dust. At completion of project, vacuum duct liner if it is dirty or dusty.
- D. If insulation is installed without horizontal, longitudinal, and end joints butted together and properly treated, installation will be rejected and work removed and replaced with work that conforms to this specification. See drawings for detail of joint treatment.

END OF SECTION 15822

SECTION 15910 - AUTOMATIC TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. All pertinent sections of this specification may be part of the work described in this section. This contractor will require coordination of other trades. This contractor will have a project manager, with not less than five years experience, on site when ATC work commences to coordinate daily work activities.

1.2 MANUFACTURER'S QUALIFICATIONS

- A. Firms regularly engaged in the manufacture of electric control equipment of types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years in the State of Utah. The manufacturer shall be represented locally by an authorized distributor or reseller that has been properly trained and certified by the manufacturer to represent their products. The manufacturer shall have had local representation or their products in the State of Utah for a consistent period of not less than 10 years.
- B. Manufacturers listed must meet the all qualifications and capabilities of this specification or will be rejected.
- C. Approved Manufacturers:
 - 1. Tour Andover Controls (TAC- CSI) by Utah Controls
 - 2. Staefa Controls (Siemens Building Technologies) by Atkinson
 - 3. Prior approved equal

1.3 CONTRACTOR QUALIFICATIONS:

- A. Qualified Bidders: As an extension to the existing State of Utah regional control system, the Automatic Temperature Control (ATC) system shall be installed and certified by a factory representative of the control manufacturer. The installation of the DDC system must be approved and certified by a factory representative of the controls manufacturer. The controls manufacturer representative must visit the job site to perform this certification.
- B. Past Projects: The BAS contractor shall have completed a minimum of 20 projects within the last five years which are at least equal in dollar value and scope to this project. The past projects shall have utilized the same control system manufacturer that is being proposed for this project. A list of similar projects, dollar amount, scope, contact names and numbers shall be provided by the BAS contractor if requested by the owner.
- C. Longevity: The BAS contractor shall have a minimum of 10 years experience (as an authorized factory support center for the controls manufacturer) installing and servicing consistent computerized building

automation control systems. Employee experience may not be substituted for company experience.

- B. The BAS contractor shall have complete engineering, service and installation departments. The contractor shall have an established 24 hour emergency service organization. The required extended service submission by the BAS contractor will include service response times and advanced replacement policies for bid consideration.
- C. Personnel, Coverage and Response Capabilities: The BAS contractor shall have service and support employees within 150 miles of the project location. The service and support employees shall be full time employees of the BAS contractor and available 24 hours a day. The BAS contractor's main office, training center, warehouse and repair center shall be in the State of Utah, within 250 miles of the project location. The contractor shall have a complete warehouse and repair facility with components to support this installation. Documentation and review of such capabilities and facilities may be required for review if requested by the owner's representative.

1.4 SCOPE OF WORK:

- A. The scope of work shall include all labor, material, and equipment necessary to replace the existing control system and provide control of new mechanical installed with this project.
- B. Install a new Direct Digital Control (DDC) for the Cedar City Courts as identified including software, hardware, programming, valves, damper actuators, sensors, and all like items, setup, start-up and owner instruction as well as all pertinent required items to insure a fully functioning DDC automation system.
- C. The existing control system including all controllers, sensors, valves, damper actuators and like items and shall be removed by the controls contractor and returned to the owner.

1.5 WORK TO BE PERFORMED BY OTHERS

- A. The Contractor shall carefully review all notes, coordination schedules, and drawings for work required under this section of the specification.
- B. Division 16 shall furnish and install all single phase and multiple phase electrical power wiring to magnetic starters, disconnect switches, and motor. Division 16 shall also provide 120v power to each ATC panel as shown on the plans. ATC contractor shall be responsible for step down transformers and 24 VAC wiring to ATC equipment.
- C. The sheet metal contractor shall install all dampers supplied by the ATC contractor. Each damper shall be installed so that it will operate freely and without binding. Each damper shall be checked and those not

properly installed shall be replaced or reinstalled without cost to the ATC contractor.

- D. The test and balance contractor shall perform a complete air systems and water balance and provide the owner with a certified compliance report. Balancing data sheets shall indicate the required and actual CFM of all supply, return and exhaust outlets or inlets, and be totaled and summarized by systems. Hydronic balancing data sheets shall list required temperature or pressure differentials used for balancing coils, radiations, condensers, etc. Sheets shall show in comparison final as balanced versus design values. The ATC contractor shall allow up to 40 hours assisting the test and balancing contractor with the commissioning of this project.

1.6 RELATED WORK:

- A. Mechanical Contractor to install all control valves and temperature sensor wells. The ATC contractor to provide ATC valves and temperature sensors wells.

1.7 ELECTRICAL WIRING:

- A. A licensed electrical contractor shall install all ATC conduit and wiring. The ATC Contractor shall be responsible for the complete ATC installation. All wiring shall be installed in accordance to the National Electrical Code and local codes. The ATC contractor shall hold a valid electrical license for the State of Utah or shall subcontract the ATC installation to one of the following.
- B. Approved electrical sub-contractors:
 - 1. Cache Valley Electric
 - 2. Sisam Electric
 - 3. Wasatch Electric
 - 4. Prior approved equal
- C. All ATC wiring shall be installed in $\frac{3}{4}$ " **conduit** (minimum) and in accordance with the National Electrical Code.

1.8 MAINTAIN SYSTEM OPERATION

- A. This project will take place in an occupied and operating building. During the entire period of construction the mechanical system must remain in operation as not to disrupt the facilities occupants. Work located in occupied areas must be done after hours as not to disrupt the work of the buildings tenants. Local shut downs are expected but shall be coordinated with other trades and per the construction schedule.
- B. The existing control system shall remain in operation until the new system has been installed and is functional.

1.9 SUBMITTALS / O&M MANUALS:

- A. Prior to any installation, the Contractor shall submit, with 15 days after award of contract, a complete submittal package. This submittal shall contain six (6) copies of complete literature on all control equipment including control diagrams as per the sequence of operation.
- B. Provide four (4) manuals in addition to those manuals specified above. These manuals shall provide descriptions of maintenance procedures for all system components, including sensors and controlled devices. They shall cover inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components. They shall include complete as-built ATC installation drawings with sequences of operation for all mechanical systems controlled by the ATC contractor. They shall each include both a hard copy & diskettes of all as-built system programming.

1.10 SEASONAL ADJUSTMENTS:

- A. Seasonal adjustments to the control system will need to be included in this bid. Depending on the finish date this contractor will schedule 8 hours, with maintenance personal to check the system in the mode of either winter conditions or summer.

1.11 PROJECT MANAGEMENT:

- A. Provide a designated project manager who will be responsible for the following:
 - 1. Construct and maintain project schedule
 - 2. On-site coordination with all applicable trades and subcontractors
 - 3. Attend project meetings
 - 4. Make necessary field decisions

1.12 WARRANTY:

- A. Provide all services, materials and equipment necessary for a one-year period after beneficial use has been established.

1.13 TRAINING:

- A. Training will consist of a factory authorized training course totaling not less than 24 hours. Classes will be held in a classroom setting with an instructor that is accredited and certified by the manufacturer. A total of up to 4 employees from the State of Utah DFCM shall be permitted attend the training course. All travel costs and course tuition shall be the sole responsibility of the ATC Contractor.

- B. In addition to the above, On site specific training shall consist of 4 hours on site and will be at the owner's time desecration. Owner to provide one week notice.

SECTION 2 - PRODUCTS AND EQUIPMENT

2.1 MANUFACTURERS:

- A. Provide new Direct Digital Controls (DDC) system as described herein. This DDC system shall be compatible with and tied into the existing State of Utah DFCM network via the existing DDC control system.

2.2. HOST COMPUTERS:

- A. Provide the following host computer:
- B. Building host computer shall have as a minimum the following:
 - 1. IBM compatible Pentium IV 2.4 GHZ
 - 2. 512 MB DDR RAM memory
 - 3. 40 GB hard drive
 - 4. One 1.4 meg, 3-1/2" floppy drive
 - 5. One 52X CD rom
 - 6. Two USB Ports
 - 7. Three button mouse w/mouse pad
 - 8. 17" flat screen monitor
 - 9. Operating system (Microsoft Windows XP Professional)
- C. The ATC contractor to provide a fully operational DDC control system that may be monitored, controlled & modified from the Centralized Host computer shall construct the controlling software database. All control schedules, algorithms, and control logic shall be in place within each DDC controller and stored as back-up copies on the Host computers hard disk which may be down-loaded to individual DDC controllers as necessary. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences.
- D. The building shall be represented by complete graphical floor plans, with accurate locations of each major piece of HVAC equipment. A zoom feature shall allow the operator to select any of the main fan systems, and see a graphical representation of the system with dynamic representation of all appropriate DDC input & output devices. Each major piece of HVAC equipment shall be graphically represented at the Host computer with all appropriate DDC points dynamically represented.

2.2 VALVES:

- A. Replace all existing ATC control valves with new. Valves to be manufactured by Belimo or Honeywell and shall utilize electronic 4-20mA,

- 2" 0-10VDC, or PWM positioning and electric actuation. ATC valve bodies and smaller shall be screw type; larger valves shall be flanged. Screwed valves shall be rated at 150 psi or greater and shall have cast iron or brass bodies. Flanged valves shall be rated at 250 psi or greater and have cast iron or steel bodies. All automatic valves shall be for DDC control application. All valves shall be disc/plug and seat or ball construction. Valves to be sized for a 3-lb. pressure drop.

2.3 DAMPERS AND ACCUATORS:

- A. All existing damper actuators shall be replaced with new. The ATC contractor shall furnish motorized control dampers that are not supplied with the air handling units. All dampers shall be factory-built, low leakage units such as Ruskin CD-50 or approved equal. Blades shall be 6" maximum width; material to be extruded aluminum, and blade linkage to be external and accessible. Frames shall be 5" x 1" and made of extruded aluminum hat channel, 0.125" minimum thickness with corner braces to assure that they are square. Dampers shall be low leakage type with compressible end seals and neoprene of extruded vinyl blade and jamb seals. Leakage shall be not exceed 6.2 cfm/sq. ft. at 4" W.G. Dampers shall require less than 7#-in/sq. ft. torque at the operating shaft.

2.4 BUILDING MANAGEMENT SYSTEM (BMS):

- A. The building management system shall permit full operator communication and control, including obtaining information about performance of this system; changing times and parameters; adding or deleting points; changing relationships between sensors and controlled equipment; creating or modifying control strategies; and diagnosing system malfunctions. English language prompting format shall be used. The operator will be presented with options at the CRT in English. Features of the system will be compatibility to run on Windows NT. System to have TCP/IP protocol communication; support for net plus routers; open database support; integrated graphic editor; asynchronous auto-dial/auto answer, and one way dialing. This Contractor shall provide all software required for efficient operation of all the automatic system functions required by this specification. Software shall be modular in design for flexibility in expansion or revision of the system. It is the intent of this specification to require provisions of a system, which can be fully utilized by individuals with no, or limited, previous exposure to PC's and programming techniques and languages. If the system to be provided requires the use of any modified BASIC, "C", PASCAL, or DRUM Language program, or writing "line" programming statements to modify operation or strategy in the system, the vendor shall provide unlimited, no charge, software modification and support for a period of five (5) years after the completion of the project in addition to the warranty period specified elsewhere. Systems, which are factory programmed, are unacceptable. Direct Digital Control (DDC) Modules: Each DCU shall

provide "Block" or "Modular" programming software so that the operator can easily develop custom control strategies and sequences of operation, without learning a programming language.

- B. Control loops and sequences shall be defined using "modules" that are analogous to traditional pneumatic or electric control devices. Modules may be linked together to form more complex control strategies. The use of mathematical equations, "BASIC", or proprietary programming languages for defining a DDC control loop is unacceptable.
- C. **Trend Sampling shall be capable through a point extension editor from the software that will allow the operator to track any or all points in the system. A minimum trend sample resolution of one minute increments and five hundred trend samples per point shall be required.**

2.5 LOCAL AREA NETWORKS (LAN):

- A. Controller LAN: The FMS shall provide communication between the DCU's over a Local Area Network (LAN).
- B. The Controller LAN shall be a "bus type" network over which information is transmitted in a "token passing" fashion between all the nodes on the network.
- C. The Controller LAN shall have the capacity to contain not less than 64 nodes as a minimum. Each work station, DCU, or "gateway" device shall represent a node to the network.
- D. The Controller LAN shall connect the nodes in a fully distributed environment, each DCU operating autonomously while communicating with all other nodes on the network. Controller LANs requiring a communication controller (for any reason) will not be acceptable. LAN lengths in excess of 24,000 ft. shall be supported.
- E. A break in the communication path of the Controller LAN shall be announced as an alarm and shall automatically initiate a Controller LAN reconfiguration such that the resulting sections of the Controller LAN continue to function as separate LANs. No loss of control shall result from such a break in the Controller LAN.
- F. Commercial LAN: Workstations on the Controller LAN may also reside on a higher tier "commercial" LAN. This "commercial" LAN shall be based on Ethernet, and comply with IEEE 802.3 standards. Where a "commercial" LAN is implemented, it shall be possible to connect multiple Controller LANs together, with global data sharing across this commercial LAN.

- G. Data speed shall not be less than 10 Megabaud.
- H. An operator at a workstation on the "commercial" LAN may connect to any other workstation on the "commercial" LAN as if the operator were sitting at the other workstation.
- I. Alarms and special event notices shall be routed to different workstations on the "commercial" LAN based on time of day, and day of the week.
- J. **Operator password assignment shall be available on both a system-wide basis and a workstation by workstation basis. All editors in the software shall be individually capable of password protecting as to allow or deny the operator the capability of access to each editor.**

2.6 DIRECT DIGITAL CONTROL SYSTEM-OVERVIEW:

- A. The direct digital control system shall consist of local microprocessor-based digital control panels (DCP) network together for information sharing and operating convenience and a central operator interface station.
- B. It is the intent of these specifications to create a combined direct digital control system. All system type control functions, such as those used for fan systems, boilers, chillers, central plant and pumps, building pressure, etc., shall be accomplished by using software algorithms in the respective DCP.
- C. Each major mechanical component shall have its own dedicated DCP so that failure of any will not result in catastrophic system failure. DCP's utilizing a master-slave relationship shall have a master unit provided for each major mechanical system.
- D. All safety devices such as fire alarm shutdown, smoke detectors, low limit thermostats, etc., shall be hard wired to accomplish their critical functions completely independent of the DCP and shall have additional outputs as required to serve as inputs to the DCP for secondary control and reporting functions.

2.7 CONTROLLER (DCU):

- A. The controller shall be a microprocessor and shall form the basic control unit of the system. It shall operate as a stand-alone unit providing all the necessary algorithms and software logic to perform the local HVAC control sequences and energy saving functions. Failure of any one DCU shall have no effect on the other DCU's in the system. Programming shall be block type and accomplished by the operator's terminal, or the remote operator terminal. The DCU shall have the ability for direct digital control; automatic time scheduling; demand limiting; calculated points universal inputs with configurable outputs; an RS-485 Lan

port; an RS-232 port; an
and on line editing
of any central

TTL port for hand held console; trend sampling,
capability. The controller shall operate independent
computer, shall have built in diagnostic routines.

- B. Inter-computer communications shall support true global token passing control strategies as well as allow data status and values connected to one DCU to be used within application programs of another DCU.
- C. The system shall provide a network communication facility to support global calculation and control strategies to be continuously implemented in the distributed system. The system shall provide for events detected in any area of the total network to initiate commands to any other device within the network. The system shall also provide for connected or calculated data to be continuously shared between any or all controllers within the total network. Through the DCU's may share none critical sensor information, at no point within the facility shall quick reacting and constantly changing point information be communicated via the network bus. These types of point shall be hardwired to the DCU in which the algorithm exists.

2.8 SOFTWARE:

- A. This contractor shall provide the most current versions of all programming, controlling, monitoring software & graphic/system displays required by the DDC system. These shall include but not be limited to DDC operating system and data files. **All software, programs and intellectual rights to the database shall become the property of the owner.**
- B. Copies of all software releases available within one year of the substantial completion shall be provided and installed to the owner at no cost.

2.9 ROUTER AND SECURITY OF CONTROL SYSTEM:

- A. Provide and install an Ethernet router at this site to provide constant on-line monitoring by the facility personnel. This device shall serve as the network interface between the ATC control/controllers at the remote site and the existing Wide Area Network (WAN). This router to tie directly to the control system. The router shall support the following protocol, Telnet via TCP, SNMP via UDP, and ATC contractor's proprietary protocol via UDP. The router shall require a Static IP address, Subnet Mask and Gateway provided by the network administrator. The maximum allowable transmission/response packet sizes shall not exceed 186 bytes, and acknowledge/response packet sizes shall not exceed 64 bytes. UDP packets shall be proprietary to the control system with critical packets using a private key encryption for security.

2.10 FREEZE PROTECTION THERMOSTAT:

- A. Freezestats shall have 20' sensing element with any foot capable of actuating contacts on a temperature drop below 35 deg F. Freezestats shall have manual reset and 4 wire double circuit block. Additional freezestats shall be installed on coils over 40-sq. ft. in size. Activation of the low limit thermostat shall stop the air handling unit, close the outside air damper, open the heating valve and start the heating booster pump.

2.11 AIR DUCT SMOKE DETECTORS:

- B. Smoke detectors shall be furnished and wired by Division 16. All smoke detectors shall be interlocked with the building fire alarm system by the electrical contractor.

2.12 TEMPERATURE SENSORS:

- A. Provide thermistor or thin film silicon sensors for all temperature applications, except differential chilled water for BTU calculation, where precision matched Platinum RTDs shall be used. Solid state sensors shall be linear, drift free, and require only a one-time calibration. A look-up table in the connected controller shall linearize thermistors or similar non-linear temperature devices. Resolution shall be better than .5 degrees F for Micro Controller applications, and better than .2 degrees F for DCP applications.
- B. Space sensors shall have an integral port for connection of a portable "intelligent" sensor to communicate with its DCP. This port and portable "intelligent" sensor may be used for initiating the "test mode" locally to verify all DCP control sequences, and perform test and balancing functions. To eliminate the downtime associated with rechargeable batteries, the portable "intelligent" sensor shall receive its power from the sensor port.

2.13 SEQUENCE OF CONTROL:

- A. FURNACE UNIT w/ DX COOLING:
 - 1. These fan systems consist of a supply fan, DX cooling, gas fired heat exchanger, filters & outdoor air and return air dampers.
 - 2. The ATC contractor shall provide spring return style modulating damper actuators for these units. The outside air shall be used as first stage cooling when permissible.

3. The supply fan shall be started from a local DDC controller. Fan operation shall be sensed by the DDC system via a current monitoring switch. If the supply fan fails to start, all heating and cooling stages shall be locked-out by the DDC system and an alarm shall be sent to the host computer.
4. Fan system operation shall be subject to building fire alarm, building optimal start-stop programs, and other conditions or logic pre-programmed into the DDC controllers.
5. The outside air dampers shall close and the DX cooling stages shall be locked-out whenever the space temperature falls below 60°F (adjustable) to protect the building from freezing.
6. The fan system shall perform an optimal start program that shall include building warm-up and building purge features. In the warm-up mode, all outside air dampers shall remain closed. In the purge mode, the outside air dampers shall open to 100% and the DX cooling stages shall remain off.
7. OCCUPIED mode: A space temperature sensor acting through DDC controllers, shall enable the gas fired furnace, DX cooling stages, and outdoor air and return air dampers to maintain the room temperature setpoint. The space sensors shall include room occupant setpoint adjustment and after hours override capability and indication via adjustable stats.
8. UNOCCUPIED mode: The space temperature sensor, acting through a DDC controller, shall cycle the supply fan and enable the gas fired furnace to maintain desired minimum space temperature. The outside air dampers shall remain closed. If the override button in the space is pressed, the fan coil system shall return to occupied mode for a one-hour period (adjustable).
9. The DDC controller shall be located in the equipment room adjacent to the furnace unit.

B. PACKAGED ROOFTOP UNITS

1. Supply fan start/stop: The supply fan will be started by the BMS according to the schedule. After the supply fan has been started, the control sequence will be enabled. Supply fan shall run continuously in "occupied" mode.
2. Zone Control: The gas heating stages and the DX cooling stages will modulate/ cycle in sequence to maintain the zone temperature at setpoint.

3. Night Setback/Night Setup: When in "unoccupied" mode, the unit will cycle as necessary to maintain the night setback zone temperature at setpoint. A differential prevents the unit from cycling excessively.
4. Shutdown: When the unit is shutdown by either a stop command or system safety the unit will be set as follows
 - a. Supply Fan will be off.
 - b. DX cooling will be off.
 - c. Gas heat will be off.
5. Power exhaust fan, outside air dampers, and relief air dampers shall modulate to maintain space static pressure.

C. FAN SYSTEM FILTER BANK ALARMS:

1. A differential pressure switch with its static pressure tips located across each fan system filter bank and makeup air unit filter bank shall provide the DDC system with the differential pressure drop across each filter bank. An alarm shall be supplied to the DDC system whenever the filter differential pressure remains above 0.35" w.c. (adjustable) for more than 15 continuous minutes.

D. FIRE ALARM FAN SHUT-DOWN (All Fan Systems):

1. All heating, ventilating and air conditioning system supply fans shall automatically shut off when the building fire alarm system is energized. All fans to automatically start up again when fire alarm system is reset. Fire alarm system fan relays shall be "normally energized" and shall be installed by Division 16 at each fan system.

END OF SECTION 15910

SECTION 15960 - AIR SYSTEM TEST AND BALANCE

PART 1 - GENERAL

1.1 SCOPE:

- A. Includes -
 - 1. Testing, balancing and adjusting of the following systems:
 - a. Supply and Return Air
 - b. Exhaust Air
 - c. Relief Air
 - 2. Test Report bound in Operating and Maintenance Manuals.
 - 3. Contractor shall make changes in pulleys, belts, motors and dampers or add dampers as required for correct balance as recommended by Air Balance & Testing Agency at no additional cost to Owner.

1.2 RELATED SECTIONS:

- A. Division 01 General and Sections 15010 and 15051 are part of this Section.

1.3 AGENCY:

- A. Contractor shall procure services of an independent Air Balance & Testing Agency which specializes in balancing and testing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
- B. Agency shall provide proof of having successfully completed at least five projects of similar size and scope and be a certified AABC or NEBB agency. Work by this Agency shall be done under direct supervision of a qualified registered professional heating and ventilating engineer employed by Agency. Agency shall maintain an office within 250 miles of project.
- C. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
- D. If requested, conduct tests in presence of Engineer.
- E. Agency shall be approved in writing by the Engineer. Neither Engineer or anyone performing other work on this Project under Division 15 shall be permitted to do this work.
- F. Contractor shall award test and balance contract to the approved agency upon receipt of his contract to proceed to allow Agency to schedule this work in cooperation with other Sections involved and comply with completion date.
- G. Balancing agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of the Air Balancing Test Report.
- H. Engineer will choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire project.
- I. Rebalancing shall be done in presence of Engineer and subject to his approval.
- J. Spot balance and rebalance shall be performed at no additional cost to Owner.
- K. Approved Balancing Agencies
 - 1. Bonneville Test and Balance
 - 2. BTC Services

3. Certified Test and Balance
4. Danis Test and Balance
5. RS Analysis
6. Technical Specialties
7. Temp Co.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Begin air balance and testing upon completion of the mechanical installation of air conditioning, ventilation, heating, exhaust systems, and controls including installation of all specialties and devices.

3.2 PROCEDURES:

- A. Before any adjustments are made, the system is to be checked for items such as dirty filters, filter leakage, major duct sections, zones, etc.
- B. Contractor shall place exhaust and ventilating systems and equipment into full operation and continue their operation during each working day of testing and balancing.
- C. Air Balance & Testing Agency shall perform tests specified, compile test data, and submit four copies of complete test data to Contractor for forwarding to Engineer for evaluation and approval.
 1. Approved copies of report shall be bound in Operations & Maintenance Manuals. See Division 15010 General.
- D. Systems shall be completely balanced and all reports submitted to Engineer prior to test run and final inspection.
- E. System performance shall be checked when outside weather is at or near design conditions, if practicable. Heating and/or cooling thermometers or sensors shall be placed in the areas served by each fan system. Temperature readings shall be taken at half hour intervals, and further adjustments or corrections made as required to obtain uniform temperatures. All occupied spaces shall be checked for drafts and noises caused by the make-up and exhaust systems, and any unsatisfactory conditions corrected.
- F. Balancing shall be performed during normal project working hours when project construction foreman is present on the job site to provide access and see his mechanical sub contractor is available to operate system and make necessary corrections.

3.3 STANDARDS:

- A. Balance shall be performed in complete accordance with the following standards as applicable to the agency certification:
 1. HVAC Systems Testing, Adjusting, and Balancing, SMACNA 1983.
 2. Testing, Balancing, and Adjusting of Environmental Systems, SMACNA 1974.
 3. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, NEBB 1983.
 4. AABC National Standards, Fourth Edition 1982.
 5. Procedural Standard for Measuring Sound and Vibration, NEBB 1977.

- B. Balancing Agency's National Certification shall warrant the system balance and performance. A copy of guarantee certificate shall be included in each test and balance report.

3.4 TESTING PROCEDURE:

- A. Air Balance & Testing Agency shall perform following tests and balance system in accordance with following requirements:
- B. Test and adjust blower rpm to design requirements.
- C. Test and record motor full load amperes.
- D. Make Pitot Tube tranverse of main supply and obtain design cfm.
- E. Test and record system static pressures, suction, and discharge.
- F. Test and adjust system for design cfm air.
- G. Test and adjust system for design cfm outside air.
- H. Test and record entering air temperatures (db heating and cooling).
- I. Test and record entering air temperatures (wb cooling).
- J. Test and record leaving air temperatures (db heating and cooling).
- K. Test and record leaving air temperatures (wb cooling).
- L. Adjust main supply and return air ducts to proper design cfm, + or - 5%.
- M. Adjust zones to proper design cfm, supply and return, + or - 5%.
- N. Test and adjust each diffuser and grille to design requirements. Individual air outlets, when one of three or more are serving one space, may have a tolerance of 10% from the average.
- O. Identify each diffuser and grille as to location and area served.
- P. Identify and list size, type, and Manufacturer of diffusers, grilles and testing equipment. Use Manufacturer's rating on equipment to make required calculations.
- Q. In readings and tests of diffusers and grilles include required cfm and fpm velocity & test cfm and fpm after adjustments.
- R. In cooperation with Section 15 900, set adjustments of automatically operated dampers to operate as specified, indicated, or noted.
- S. Adjust diffusers and grilles to minimize drafts.

3.5 EXHAUST AIR SYSTEMS:

- A. Systems are to be adjusted to same tolerance as supply systems. Each space is to be checked to see that it is positive, neutral or negative as indicated by quantities of supply and exhaust air shown on contract documents. Any discrepancies shall be investigated and corrected, and the proper pressure relationship established.
- B. Building pressure shall be checked at outside doors, relief air damper adjusted as required to leave building neutral or under slight positive pressure.

3.6 REPORT

- A. Report shall include:
 - 1. Record test data on AABC standard forms or facsimile thereof.
 - 2. A set of black and white or blue line prints with all air openings marked to correspond with data sheets and with temperature clearly marked.
 - 3. Show on final report the percent of design CFM to the actual CFM of each diffuser represents.

4. The certified report shall include for each air handling system the data listed below:
 - a. Equipment
 - 1) Installation data
 - a) Manufacturer and model
 - b) Size
 - c) Arrangement, discharge, and class
 - d) Motor hp, voltage, phase, cycles, and full load amps
 - e) Location and local identification data
 - 2) Design data
 - a) Data listed in schedules on drawings and specifications.
 - 3) Fan recorded (test) data
 - a) cfm
 - b) Static Pressure
 - c) rpm
 - d) Motor operating amps
 - e) Motor operating bhp
 - b. Duct systems
 - 1) Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust.
 - a) Duct size(s)
 - b) Number of Pitot tube (pressure) measurements.
 - c) Sum of velocity measurements (Note: Do not add pressure measurements)
 - d) Average velocity
 - e) Recorded (test) cfm
 - f) Design cfm
 - 2) Individual air terminals
 - a) VAV box number and maximum and minimum settings.
 - b) Terminal identification (supply or exhaust, location and number designation)
 - c) Type size, manufacturer and catalog identification
 - d) Applicable factor for application, velocity, area, etc., and designated area
 - e) Design and recorded velocities - fpm
 - f) Design and recorded quantities - cfm
 - g) % of design recorded quantity- cfm represents

END OF SECTION 15960

INDEX

DIVISION 16 - ELECTRICAL WORK

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SECTION 16000 - GENERAL PROVISIONS, ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions and Division 1 Specification Sections apply to work of this section and all other Division 16 specification sections.
- B. This section applies to all Division 16 specification sections.

1.2 SUMMARY

- A. This section includes general administrative and procedural requirements for electrical installations to expand the requirements of the General Conditions and Division 1 Specification Sections.

1.3 STANDARDS

- A. The following industry standards are considered minimum requirements for electrical work and are made a part of the contract documents:
 - 1. National Electrical Code, 2002 Edition (NEC)
 - 2. Electrical Ordinances of Local Governing Authority
 - 3. Utah State Fire Marshal's Rules and Regulations
 - 4. International Building Code
 - 5. International Fire Code
 - 6. Underwriters Laboratories (UL) Standards
 - 7. American National Standards Institute (ANSI)
 - 8. National Electrical Manufacturer's Association (NEMA)
 - 9. National Fire Protection Association (NFPA) Standards
 - 10. Regulations of American Standards Association
- B. If any conflict occurs between these rules and the contract documents or between the plans and specifications, notify the Project Engineer promptly in writing. Do not proceed with any work in conflict until a solution is approved in writing by the Project Engineer.

1.4 WORKMANSHIP

- A. All Electrical Work of any nature shall be performed by qualified electricians, experienced in the type of work to be performed and licensed with the State of Utah. Electricians shall show their license upon request of the Owner, Project Engineer and/or their representatives.

1.5 ELECTRICAL WORK INCLUDED

- A. The basic contract work includes all labor, material, tools, transportation, equipment, and superintendence specified, indicated on the drawings or necessary to make a complete installation of, but not limited to, the following:
 - 1. Appliances, apparatus and materials not specifically noted on drawings or mentioned herein, but which are necessary to make a complete working installation of all electrical systems required for the project.
 - 2. Hangers, anchors, sleeves, chases, supports and fittings as may be required and as indicated.

3. Electrical service to new heating, ventilating and air conditioning equipment circuit breakers, safety switches and branch circuits.
4. All receptacles, etc. as indicated on drawings.
5. Existing Fire Alarm System additions and modifications, complete with all equipment in operative condition.

1.6 SUBSTITUTIONS

- A. Material or products specified by name of manufacturer, brand or trade name or catalogue reference will be the basis of the bid and furnished under the contract unless changed in writing by the Project Engineer. Where two or more materials are named, the choice of these will be optional with the Contractor.
- B. Submit requests for substitution in writing to the Project Engineer with copy to Consulting Engineer, in accordance with the General Conditions.

1.7 ACCURACY OF DATA

- A. Data given herein and on the drawings are as exact as could be secured, but their absolute accuracy is not guaranteed. Specifications and drawings are for the assistance and guidance of the Contractor.
- B. Electrical drawings are diagrammatic, but will be followed as closely as building construction and work of other contractors will permit. All deviations from the drawings required to make the Electrical Work conform to the existing building and to the work of other contractors will be made by the Contractor as approved by the Project Engineer.

1.8 VISIT THE SITE

- A. Contractors are assumed to have visited the site and thoroughly acquainted themselves with conditions affecting the proposed work. Verify existing conditions and measurements at the building before beginning work and immediately notify the Project Engineer of any discrepancies which may adversely affect completion of the work.

1.9 TEMPORARY POWER

- A. Provide temporary power for reasonable convenience during construction in accordance with the General Conditions.
- B. Provide GFCI Protection for all temporary power outlets.
- C. Use temporary power for construction purposes only. Do not use temporary power for electric space heating, etc..

1.10 SHOP DRAWING SUBMITTALS

- A. As soon as possible after contract award, submit shop drawings for review in accordance with the General Conditions and Division 1 Specifications.
- B. Provide manufacturers' catalogue and/or descriptive literature indicating specific model and/or catalog numbers, options, accessories and modifications for the following items:
 1. Safety Switches
 2. Circuit Breakers
 3. Motor Starters

4. Fire Alarm System

- C. Above list is considered minimum. Additional items may be required to be submitted for review.
- D. Refer to individual Specification Sections for additional Shop Drawing Submittal requirements.

1.11 RECORD DRAWINGS

- A. Provide As-Built Record Drawings in accordance with the General Conditions and Division 1 Specifications.
- B. Indicate all changes made to the drawings such as changes in equipment and outlet locations, changes in circuit routing and circuit numbering, etc. Include all changes by Addenda, Change Order, Supplemental Instruction or verbal instruction.
- C. Refer to individual Specification Sections for additional Record Drawing requirements.

1.12 OPERATION AND MAINTENANCE MANUALS

- A. Provide Operation and Maintenance Manuals in accordance with the General Conditions and Division 1 Specifications.
- B. Include manufacturers' catalog and/or descriptive literature of equipment actually installed. Clearly indicate on literature the specific model and/or catalog numbers of equipment installed, including all options, accessories and/or modifications.
- C. All copies of literature will be new, clean and clearly legible.
- D. Refer to individual Specification Sections for additional Operation and Maintenance Manual requirements.

1.13 WARRANTY

- A. Provide Warranty for Electrical Work in accordance with the General Conditions and Division 1 Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials and equipment for which U.L. Standards have been established, will be listed by and bear the label of Underwriters Laboratories, Inc..
- B. All materials will be new and bear the manufacturer's name, trade name and catalog or model numbers. Similar items will be of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of materials will comply with all codes and be accomplished with good workmanship in the judgement of the Project Engineer.

3.2 COOPERATION WITH OTHER CONTRACTORS

- A. Cooperate with other contractors doing work on the building as may be necessary for the proper execution of the work of various trades employed in construction of the building.

- B. Refer to drawings, for construction details, and coordinate the electrical work with that of other contractors to the end that unnecessary delays and conflicts will be avoided.

3.3 MATERIAL HANDLING

- A. Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Project Engineer and at no additional cost to the Owner.

3.4 CUTTING AND REPAIRING

- A. Provide all required digging, cutting, etc. incidental to the Electrical Work. Make required repairs thereafter to the satisfaction of the Project Engineer.
- B. Do not cut into any major structural element, beam or column, without written approval of the Project Engineer.
- C. Install the Electrical Work to proceed with other trades in order to avoid unnecessary cutting of the construction.

3.5 CONSTRUCTION REVIEW

- A. The Owner and/or Project Engineer will perform construction review throughout the construction of the project. The construction review does not relieve the contractor from the responsibility of providing all materials and performing the work in accordance with the Contract Documents.
- B. Notify the Project Engineer in writing, giving ample notice, at the following stages of construction and allow the Owner and/or Project Engineer to review the installed work.
 - 1. When all electrical rough-in is complete, but not covered.
 - 2. Pre-Final, upon completion of all electrical work.
 - 3. Final, upon completion of all items noted in the Pre-Final Construction Review Report.
- C. Test all systems and equipment provided and/or connected under the Contract for short circuits, ground faults, proper neutral connections and proper operation in the presence of the Owner and/or Project Engineer.
- D. The entire construction will be installed in accordance with the contract documents and be free of mechanical and electrical defects prior to final acceptance of the work.

* END OF SECTION 16000 *

SECTION 16060 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Division 1 Demolition Sections.

1.2 SCOPE

- A. Remove electrical equipment and wiring systems and make required extensions and reconnections as shown on Drawings and specified herein.
- B. Repair all damage resulting from demolition and extension work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Provide new materials and equipment for patching and extending work as specified in the appropriate Specification Section for the materials and equipment involved.
- B. Where materials or methods not included in the Specifications are required, provide materials and methods in accordance with normal construction industry standards and as approved by the Project Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field verify existing measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on available existing building electrical drawings. Report discrepancies to the Project Engineer before disturbing existing installation.
- D. All demolition and extension work is not necessarily indicated on Drawings. Include all such work without additional cost to Owner.

3.2 PREPARATION

- A. Coordinate utility service outages with Utility Company.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use electricians experienced in such operations.
- C. Protect all existing electrical equipment to remain from damage during demolition and new construction. Survey all existing equipment prior to beginning work and document in writing or by photograph any existing damage to existing equipment.

3.3 DEMOLITION

- A. Coordinate with Owner for equipment and materials to be removed by Owner or salvaged by the contractor for Owner. Place salvaged equipment and materials in storage at the project site as directed by the Owner.
- B. Legally dispose of all removed equipment and materials not salvaged for the Owner.
- C. Remove abandoned wiring to source of supply, i.e. panelboard, circuit breaker, etc..
- D. Remove accessible abandoned conduit, cables, junction boxes, etc., including above accessible ceilings. Cut conduit flush with walls and floors.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlet boxes and conduit servicing them where indicated on drawings. Provide blank cover for abandoned outlets which are not indicated to be removed.

3.4 EXTENSION OF EXISTING ELECTRICAL WORK

- A. Reconnect existing equipment where demolition interrupts existing branch circuits or feeders to the equipment.
- B. Repair adjacent construction and finishes damaged during demolition and extension work to match surrounding surfaces.
- C. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- D. Extend existing installations using materials and methods as specified for new work. Remove and replace existing installations which are not compatible with new work.

3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide new typed circuit directory showing revised circuiting arrangement.

3.6 INSTALLATION

- A. Install relocated materials and equipment as required for new materials and equipment.

3.7 OUTAGES

- A. Maintain Existing Electrical Systems in service until new systems are complete and ready for service. Disable systems only to make switchovers and connections. Minimize outage duration.
- B. Obtain permission from Owner and/or Project Engineer before partially or completely disabling systems in accordance with Division 1 Specification Sections.

* END OF SECTION 16060 *

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide a complete raceway system for all wiring as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Provide minimum 3/4" trade diameter raceways for all wiring systems.
- B. Do not use aluminum conduit, intermediate steel conduit (IMC), BX cable, MC cable, Flexible Non-metallic Tubing, NM cable, Direct Burial Cable or any other wiring methods not allowed by this specification unless approved in writing by the Project Engineer and/or Engineer.

2.2 ABOVEGROUND RACEWAYS

- A. Provide Electrical Metallic Tubing (EMT), galvanized inside and out, for raceways not subject to permanent moisture or damage.
- B. Provide Galvanized Rigid Steel Conduit (GRC) where raceways are subject to permanent moisture such as underground, or damage such as vehicular traffic, etc..

2.3 FLEXIBLE RACEWAY CONNECTIONS

- A. Provide Flexible Steel Conduit for final connection to motors and equipment subject to vibrations or movement, not to exceed 3 feet in length.
- B. Provide liquid-tight flexible steel conduit outside and in wet, humid, corrosive and oily locations.
 - 1. Provide Sunlight Resistant liquid-tight flexible steel conduit outdoors.
- C. Provide a ground conductor in all flexible steel conduit.
- D. Flexible Steel Conduit may be used where misalignment or cramped quarters exist only with prior approval of the Project Engineer and/or Engineer.
- E. Flexible Steel Conduit may be used to fish through existing walls and ceilings only with prior approval of the Project Engineer.

2.4 CONDUIT FITTINGS

- A. Provide steel compression type or steel set screw type fittings for Electrical Metallic Tubing.
- B. Provide malleable iron clamp type fittings for Flexible Steel Conduit.
- C. Provide steel compression type fittings for Liquid-Tight Flexible Steel Conduit.

- D. Provide threaded fittings for GRC conduit. Provide double locknuts and plastic bushing for GRC conduit terminations or provide boxes and enclosures with threaded hubs.
- E. Provide steel rain-tight, compression type fittings for all conduit installed outside and in wet, humid, corrosive and oily locations.
- F. Provide Insulated Throat Connectors for all conduit terminations 1" diameter and smaller. Provide insulating bushings for all conduit terminations 1-1/4" diameter and larger.
- G. Provide Grounding Bushings bonded to the electrical system ground:
 - 1. On each end of all conduits used to protect ground conductors.
 - 2. On all conduit terminations installed in concentric or eccentric knockouts or where reducing washers have been installed.
- H. Do not use cast metal or indenter type fittings. Do not use screw-in type fittings for Flexible Steel Conduit. Do not use spray (aerosol) PVC cement.

2.5 RACEWAY SEALS

- A. Seal all conduit penetrations through fire rated walls, ceilings and floors with a UL classified fire barrier system as manufactured by Scotch 3M or Nelson Electric which will provide an immediate fire seal, require no curing time, and emit no hazardous or toxic fumes.
- B. Seal all conduit penetrations through airtight spaces and plenums with an approved mastic compound acceptable to the Project Engineer to prevent air leakage.

2.6 ROOF PENETRATIONS

- A. Provide Galvanized Steel or Lead roof jacks of suitable style and material for all conduit penetrations through roof to provide a weathertight seal. Coordinate style, material and installation with the general contractor.

2.7 PULL BOXES

- A. Provide pull boxes or conduit bodies in accessible locations where required to reduce the number of bends in the conduit run to less than 360 degrees and at points not exceeding 100 feet in long branch circuit conduit runs.
 - 1. Indicate exact location of pull boxes and conduit bodies on the As-Built Record Drawings.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Securely support all raceways with full (2 hole) pipe straps, hangers, or ceiling trapeze directly from building structure such as roof trusses, beams, floor joists, etc., in accordance with Specification Section 16190 - Supporting Devices.
 - 1. Do not support raceways from other electrical systems or mechanical systems.
- B. Provide supports at 5'-0" on center with a minimum of two supports for each ten foot length of conduit or fraction thereof up to 6 feet.
- C. Provide a support within 12" of each coupling, fitting, box, enclosure and bend.

- D. Install supports at vertical to horizontal conduit bends on the upper side of the bend.

3.2 INSTALLATION

- A. Raceway layouts on the drawings are generally diagrammatic and the exact routing of raceways will be governed by structural conditions and the work of other contractors.
- B. Install raceways concealed within finished ceilings, walls and floors except where exposed raceways are specifically shown on the drawings or permitted by the Project Engineer.
- C. Install exposed raceways parallel with or perpendicular to walls and ceilings, with right angle turns consisting of symmetrical bends or conduit bodies equal to Crouse-Hinds "Condulet". Avoid all bends and offsets where possible.
 - 1. Paint all exposed raceways to match surrounding surfaces.
- D. Install raceways minimum 12" from insulation of hot water piping, steam piping and other systems or equipment with temperatures in excess of 104° F (40° C).
- E. Make all field bends and offsets with a radius not less than allowed by the National Electrical Code for the type of raceway system.
 - 1. Do not install bends or offsets which are flattened, kinked, rippled or which destroy the smooth internal bore or surface of the conduit.
- F. Cap the open ends of raceways during construction to prevent the accumulation of water, dirt or concrete in the raceways. Thoroughly clean raceways in which water or other foreign matter has been permitted to accumulate or replace the raceway where such accumulation cannot be removed by a method approved by the Project Engineer.
- G. Do not install raceways which have been crushed or deformed in any manner.
- H. Do not install wiring until work which might cause damage to the wires or raceways has been completed.

* END OF SECTION 16110 *

SECTION 16120 - CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all conductors for power and lighting as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Provide Copper building wire, minimum #12 AWG, with type THHN/THWN or XHHW 600 volt insulation, except as otherwise noted on the drawings or required by NEC.
- B. Provide stranded conductors for wires #8 AWG and larger and for terminal connections to all motors. Stranded or solid conductors may be used for sizes smaller than #8 AWG at the contractor's option.
- C. Provide conductors with surface printed identification showing conductor size and material, insulation type, voltage rating and approvals at regularly spaced intervals of 24".
- D. Do not use sizes smaller than #12 AWG in branch circuits carrying load. Circuits requiring larger sizes to meet voltage drop conditions, etc., are indicated on the drawings.
 - 1. Where branch circuit homeruns indicate conductor size, use that size conductor for the entire branch circuit, including switch legs, etc.
- E. Do not use aluminum conductors.

2.2 SPLICES

- A. Provide Ideal wirenuts or Scotchlock spring connectors for all conductor splices #8 AWG and smaller. Provide split-bolt or compression type connectors for all conductor splices larger than #8 AWG.
- B. Provide splices which are UL listed for the type, quantity and size of the conductors to be spliced.
- C. Provide all splices with insulation at least equal to that of the conductor.
- D. Provide watertight splices in junction or outlet boxes located outside and in wet locations. Provide heat shrink insulating kits or use connectors pre-potted with an approved waterproof compound.
- E. Splice conductors only in approved boxes. Do not splice conductors in conduit bodies.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all conductors in approved raceway systems.

- B. Install conductors continuous without splice between outlet boxes, devices and panelboards.
 - 1. Provide suitable junction boxes in readily accessible locations where splices are necessary at intermediate points. Indicate exact location of all boxes on the As-Built Record Drawings.
- C. Do not install wiring until work which might cause damage to the wires has been completed.

3.2 COLOR CODING

- A. Color code all wiring at each enclosure and box where conductors are accessible and at each splice, tap or termination by means of colored conductor insulation.
 - 1. For conductors #6 AWG and larger, colored self-adhesive tape with the appropriate color designations may be used.
- B. Color code each conductor of each circuit as follows.
 - 1. Ground: Green or Bare Copper
 - 2. 120/208 Volt, 3 Phase, 4 Wire System
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 - 3. Match existing conductor color coding if different than above.
- C. Color code switch legs and travelers according to phase with colors other than used for phase conductors, to be consistent throughout the project.

3.3 MULTI-WIRE BRANCH CIRCUITS

- A. Where a common neutral is run for multi-wire branch circuits, connect phase conductors to separate phases such that the neutral conductor will carry only the unbalanced current. Use neutral conductors of the same size as the phase conductors unless specifically noted otherwise.
- B. Do not install more than three phase conductors in any raceway except where specifically shown on the drawings or approved by the Project Engineer and/or Engineer.

3.4 PHASE ROTATION

- A. Phase rotation for Three Phase System will be A leads B Leads C from front to back, from left to right or from top to bottom as viewed from the front of the enclosure.

* END OF SECTION 16120 *

SECTION 16130 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide junction boxes and outlet boxes at each outlet, fixture and other device location as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 OUTLET AND DEVICE BOXES

- A. Provide galvanized or cadmium plated sheet steel electrical boxes in indoor dry locations, of the most suitable size and shape for the conditions encountered and in accordance with NEC requirements for the number of conductors allowed.
- B. Provide minimum 4" Square or Octagonal, 1-1/2" Deep Boxes unless specifically indicated otherwise on the drawings.
 - 1. Provide minimum 4" Square or Octagonal, 2-1/8" Deep Boxes where Three (3) conduit connections are required.
 - 2. Provide minimum 4-11/16" Square, 2-1/8" Deep Boxes where Four (4) or more conduit connections are required.
 - 3. Provide gang boxes where more than one device is located at the same point.
 - 4. Boxes smaller than 4" Square or Octagonal, even though of equivalent cubic inch capacity, are not acceptable.
- C. Provide Type FD cast metal boxes outside, in wet, humid or corrosive locations and where exposed to damage such as vehicular traffic.
- D. Confer with the various equipment suppliers and either use or properly provide for boxes which are furnished with the equipment, such as speakers, horns, bells, etc..
- E. Do not use "THRU-THE-WALL" boxes, sectional (gangable) boxes or non-metallic boxes.

2.2 JUNCTION BOXES

- A. Provide junction boxes as specified for outlet and device boxes except that boxes 6" square and larger may be painted sheet steel.

2.3 BOX ACCESSORIES

- A. Provide fittings, plaster rings, cover plates and other accessories suitable for the purpose and location of each box.
- B. Provide plaster rings which are minimum 1/8" deeper than wall covering for flush mounted boxes (i.e. use 3/4" plaster ring for 5/8" gypsum board wall covering) such that plaster ring will be flush

with finished face of wall.

- C. Provide industrial raised covers for surface mounted outlet and device boxes.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Support each box from the building structure independent of the raceway system.
- B. Support flush mounted wall boxes with metal bar hangers or metal stud backing behind the box secured to wall studs.
- C. Secure surface mounted boxes to building structure with minimum of 2 screws or bolts as required.
- D. Do not use side mounted boxes or brackets.

3.2 INSTALLATION

- A. Install flush mounted boxes, after being equipped with extensions, accessories, etc., flush with finished face of wall, ceiling or floor. Replace or repair all boxes not installed flush with finished surfaces to the satisfaction of the Project Engineer.
- B. Seal around the surface of all switch and outlet boxes with plaster or grout to close any opening between the outlet box and the wall finish.
- C. Install boxes level and plumb.

3.3 LOCATIONS

- A. The wiring system layouts on the drawings are generally diagrammatic and the location of outlets and equipment are approximate.
- B. Study all available drawing details, shop drawings, equipment drawings, building conditions and materials surrounding each outlet and device box prior to installing the box to ascertain the exact location required for each box.
- C. The right is reserved to make any reasonable change in the location of the outlets before roughing in, without involving additional expense.

3.4 MOUNTING HEIGHT

- A. Install outlet and device boxes at the heights shown on the drawings or as directed by the Project Engineer. In general, mount outlets as follows.
 - 1. Convenience Outlet 18"
- B. All mounting heights, including mounting heights indicated on drawings, are to the center of the outlet box above finished floor or grade unless noted otherwise.
- C. Refer to applicable Specification Sections for mounting heights of devices and equipment not included above or install at heights as directed by the Project Engineer and/or Engineer.

* END OF SECTION 16130 *

SECTION 16140 - OUTLETS AND WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all wiring devices complete with coverplates and necessary accessories as shown on the drawings and as specified herein.

1.3 SUBMITTALS

- A. Provide submittals for each type of wiring device to be used on the project in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the contract documents.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. Provide wiring devices rated 20 amps minimum, as specified below, or equivalent of Eagle, General Electric, Hubbell, Leviton or Pass & Seymour.
 - 1. Receptacle, duplex convenience, 3-wire Bryant 5352
 - 2. Receptacle, duplex, GFCI protected Bryant GFR53FT
- B. Color of devices will be gray unless directed otherwise by the Project Engineer.
- C. Provide convenience outlets with GFCI protection in accordance with NEC requirements, where installed outside or within 6 feet of any sink and as indicated on the drawings.
 - 1. Provide a self-adhesive printed label stating "GFCI PROTECTED" for each outlet protected by feed-through GFCI receptacles or GFCI circuit breakers.
 - 2. Use feed-through GFCI outlets only to protect other outlets within sight of the GFCI protected outlet.

2.2 COVERPLATES

- A. Provide a cover plate for each outlet and box suitable for the location and function of the outlet and box.
- B. Provide blank cover plates for junction boxes and outlet boxes not used.
- C. Provide Stainless Steel coverplates unless directed otherwise by the Project Engineer.
- D. Provide UV Stabilized Polycarbonate, "Raintight While In Use" coverplates with spring return lids and suitable gasket as manufactured by Eagle or Taymac for all devices installed outside or in wet locations.

2.3 ACCESSORIES

- A. Equip each outlet with devices suitable for the purpose of the outlet and with means of properly connecting the equipment served, whether or not such devices are specifically mentioned.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Properly locate each outlet to fulfill its particular purpose. Do not install receptacles or boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.
- B. Install all outlets and wiring devices flush with face of coverplate, with the coverplate in contact with the finished face of the wall and with mounting strap of device in contact with the outlet box.

* END OF SECTION 16140 *

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide suitable supporting devices for all electrical equipment, raceways and components as specified herein and as shown on the drawings.
- B. Refer to individual specification sections for additional supporting requirements.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Provide support anchors which will support in tension a minimum of 4 times the weight of the equipment to be supported but not less 100 lbs.
- B. Provide wood screws in wood; toggle bolts in hollow masonry units; expansion bolts with lead shield or shot anchors in concrete and brick; and machine screws, threaded 'C' clamps or spring-tension clamps on steel work.
- C. Do not use tie wire for support unless specifically called for in individual specification sections.
- D. Do not use threaded C Clamps on tapered steel sections.
- E. Do not weld supports, equipment, boxes, raceways, etc., to steel structures.
- F. Do not use wooden plugs or plastic inserts as a base for supports.
- G. Do not use shot anchors or drilled anchors of any kind in prestressed or post-tensioned concrete slabs and beams except as approved in writing by the Project Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Secure supporting devices to building structure.
- B. Do not install supporting devices with sheetrock or plaster as the sole means of support. Provide proper blocking behind the sheetrock or plaster as required to support equipment.

* END OF SECTION 16190 *

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide identification of all electrical equipment, devices, enclosures, conductors, cables, etc., as shown on the drawings and as specified herein.
- B. Refer to individual specification sections for additional identification requirements.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Provide engraved laminated micarta or plastic nameplates to identify each panelboard, cabinet, motor starter, disconnect, etc., with the following minimum lettering heights:
 - 1. Disconnects, motor starters, etc. - 1/4"
- B. Provide Black Nameplates with White Lettering unless noted otherwise, or required to contrast with equipment enclosures.
- C. Do not use Dynamo Labels, printed labels, etc., unless specifically called for in other specification sections or approved by the Project Engineer and/or Engineer.

2.2 EQUIPMENT IDENTIFICATION

- A. Provide engraved nameplates on the exterior of each Motor Starter, Safety Switch, etc., to include the Equipment Description, Number or Designation, Voltage, Motor Horsepower and/or Full Load Amps and the Circuit from which the equipment is served.
 - 1. Example: ROOFTOP UNIT RT-2
 48.6 AMPS, 208 VOLT, 3Ø
 CIRCUIT C-7
- B. Provide engraved nameplates on the exterior of feeder and other major junction boxes and pull boxes to indicate the function of the wiring within the box such as "PANEL 'A' FEEDER" or "FIRE ALARM PULLBOX".

2.3 CONDUCTOR IDENTIFICATION

- A. Identify each branch circuit and each feeder conductor at each outlet box, pull box or other accessible location with hand lettering in black India ink in the enclosure to indicate panel and circuit numbers of all conductors in the enclosure.

2.4 PANELBOARD CIRCUIT INDEX

- A. Provide a new neatly typed index to include type of load served and the specific location of the load for each branch circuit of each existing panelboard in which branch circuits are added and/or deleted to reflect the changes in circuiting.

B. Examples

1. Lighting, Southwest Conference Room
2. Lighting, 2nd Floor Conf. Rm and Office 208
3. Outlets, SW Conf. Rm, west and north walls

- C. Do not use room numbers shown on plans, use room numbers or nomenclature assigned to rooms by the Owner. Do not use remarks from panel schedules on drawing, the remarks are for the Contractor's reference only.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install nameplates to be visible from normal viewing angles.
- B. Attach nameplates to equipment enclosures with stainless steel screws or rivets. Adhesives are not acceptable.
- C. Install panel index behind protective plastic covering.

* END OF SECTION 16195 *

SECTION 16400 - SECONDARY SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide modifications and additions to the existing electrical service as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. The Existing Secondary Electrical Distribution System is 120/208 Volt, Three Phase, Four Wire, 60 Cycle for Lighting, Equipment, Appliances and Outlets.

PART 3 - EXECUTION

3.1 FEEDERS

- A. Before or during final job site observation, check existing panel feeders and main feeder for balance of load on each phase, and make necessary adjustments to insure acceptable balance.

3.2 POWER OUTAGES

- A. Power outages to any portion of the existing building will not be allowed except on weekends, holidays and/or as directed by the Owner.
 - 1. Submit written requests for power outages to the Owner not less than Seven (7) working days prior to all proposed outages.
 - 2. Do not take any power outages without the Owners permission.

* END OF SECTION 16400 *

SECTION 16440 - SAFETY SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16475 - Fuses

1.2 SCOPE

- A. Provide all disconnect switches required by NEC or local regulations as shown on drawings and specified herein.

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Safety Switch type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include Manufacturer's standard published literature for each switch type. Clearly indicate all options, accessories, finishes, etc., to be provided with each switch type.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

- A. Provide NEMA KS1, Heavy Duty Type HD, horsepower rated, quick-make, quick-break enclosed load interrupter knife switches, fusible or non-fusible as required, with externally operable handle, lockable in the OFF position and interlocked to prevent opening front cover with switch in ON position.
- B. Maximum voltage, current rating and horsepower rating will be clearly indicated on a metal plate riveted or otherwise permanently fastened to the switch enclosure.
- C. Provide switches with NEMA 1 enclosures or where indicated as weatherproof, NEMA 3R enclosures.

2.2 ACCEPTABLE MANUFACTURERS

- A. Acceptable safety switch manufacturers, subject to compliance with the contract documents, are Challenger, Cutler Hammer, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Provide a minimum of four supports, located at each corner of each switch enclosure. Where the enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

- A. In general, mount safety switches 5'-0" above finished floor or grade to center of switch.

- B. For exterior disconnects at condensing units or packaged rooftop units, mount top of switch at the same height as the top of the unit but not less than 24" above grade or roof to the bottom of the switch.

3.3 IDENTIFICATION

- A. Provide an engraved nameplate for each switch in accordance with Section 16195 - Identification.
- B. Provide adhesive tag on inside door of each fused switch indicating NEMA fuse class and rating installed.

* END OF SECTION 16440 *

SECTION 16450 - SECONDARY GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Ground all non-current carrying metallic parts of electrical equipment, raceway systems and the neutral conductor of the wiring system as shown on the drawings and specified herein.

PART 2 - PRODUCTS

2.1 GROUND CONNECTIONS

- A. Make ground connections to the existing building ground system and extend to new electrical equipment, raceways, outlets, etc..
- B. Bond the neutral conductor to electrical service ground system at the main transformer and the main service equipment only.
- C. Bond all interior metallic piping systems to the electrical service ground system.
- D. Make above ground connections by means of pressure connectors, compression connectors, clamps or other means which are UL Listed and classified as suitable for purpose.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Leave ground connections accessible for inspection.
- B. Connect grounding conductors for grounding receptacles, etc., to a ground terminal in the panelboard. Provide a separate ground terminal for each grounding conductor as it is brought into the panelboard.
- C. Install all grounding in accordance with the latest edition of the National Electrical Code.

* END OF SECTION 16450 *

SECTION 16470 - CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide new branch circuit breakers in existing panelboards to serve new branch circuits as shown on drawings.

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each breaker type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

PART 2 - PRODUCTS

2.1 CIRCUIT BREAKERS

- A. Provide thermal-magnetic type circuit breakers unless noted otherwise.
- B. Provide multi-pole breakers with trip elements in each pole and common trip handle.
- C. Provide "HACR" rated circuit breakers to serve heating, ventilating and air conditioning equipment branch circuits.
- D. Provide "SWD" rated circuit breakers to serve all lighting and outlet branch circuits.
- E. Provide new circuit breakers in existing panelboards of the same type as the existing circuit breakers. Provide new mounting hardware, connectors, dead front covers, etc., as required to install the new circuit breakers.
- F. Plug-in breakers are not acceptable for use in panelboards.

2.2 INTERRUPTING RATING

- A. Provide circuit breakers with minimum short circuit current interrupting ratings as shown on the drawings.
- B. The interrupting rating of circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short circuit current rating specified for the panelboards.
- C. The minimum interrupting ratings of circuit breakers used as feeders and branches may be in accordance with UL 489 tested and certified series-connected circuit breaker combinations. All electrical equipment using the Series Rated circuit breaker combinations shall be clearly marked on the panel nameplate and feeder breaker indicating the same.

2.3 ACCEPTABLE MANUFACTURERS

- A. New circuit breakers shall be of the same manufacturer as the existing panelboards.

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. Provide new neatly typed circuit index for each panelboard in which circuits are added, deleted, or modified, in accordance with Section 16195 - Electrical Identification.

* END OF SECTION 16470 *

SECTION 16475 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide fuses of the proper sizes and rating for each fusible switch as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 FUSES

- A. Provide UL Class L or UL Class R, current limiting fuses, rated for up to 200,000 amperes interrupting capacity.
 - 1. For branch circuits feeding motors, furnish UL Class RK5, Time-Delay fuses and for branch circuits other than motors, furnish UL Class RK5 non time delay fuses.
- B. Provide fuses which are a standard product of Bussman, Cefco, Gould/Shawmut, or Reliance.

2.2 SPARE FUSES

- A. Provide a 20 percent complement, but not less than three, of each rating of each type of fuse used on the project. Turn over spare fuses to the Owner prior to Substantial Completion.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install only fuses of the same type and rating in each fusible switch.

3.2 COORDINATION

- A. Coordinate fuse sizes for packaged mechanical equipment with mechanical contractor. Provide fuse sizes as indicated on the equipment nameplate.

* END OF SECTION 16475 *

SECTION 16480 - MOTOR STARTERS AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide motor starters, pushbutton stations, and other necessary operating devices for all Motors and Equipment as shown on the drawings and as specified herein.

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Motor Starter in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include Manufacturer's standard published literature for each starter type. Clearly indicate all sizes, ratings, control devices, options, accessories, finishes, etc., to be provided with each starter.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Unless otherwise noted herein or on the drawings, motors will be furnished under Division 15 Specification Sections.
- B. In general, motors 1/2 HP and smaller will be Single-Phase rated at 115 or 120 volt. Motors and equipment larger than 1/2 HP will be Three-Phase with nameplate rating of 200 or 208 volt when used on a 120/208 volt system.

2.2 MANUAL MOTOR STARTERS

- A. Provide Allen Bradley Bulletin 600 single phase manual thermal overload switches with overload heaters for each single phase motor where indicated on drawings.

2.3 MAGNETIC MOTOR STARTERS

- A. Unless otherwise noted herein or on the drawings, motors starters will be furnished under Division 15 Specification Sections as part of packaged mechanical equipment.

2.4 ENCLOSURES

- A. Provide starters with NEMA 1 Enclosures where located in indoor normally dry locations.
- B. Provide starters with NEMA 12 Enclosures where located in humid, corrosive and oily locations such as Boiler Rooms, etc..
- C. Provide starters with NEMA 4X enclosures where located in outside or in wet locations. Provide suitable drain for starters located outside in accordance with the manufacturers written instructions.

2.5 HEATER CHARTS

- A. Provide manufacturer's standard chart inside the door of each starter indicating overload heater types, sizes and ratings for the starter.

2.6 ACCEPTABLE MANUFACTURERS

- A. Acceptable motor starter manufacturers, subject to compliance with the contract documents, are Allen Bradley, Challenger, Cutler Hammer, Furnas, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Provide a minimum of four supports, located at each corner of each enclosure. Where enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

- A. In general, mount individual motor starters 4'-0" above finished floor or grade to center of starter.

3.3 COORDINATION

- A. Give special attention to wiring and controls for two-speed motors or motors with special controls at no additional cost to the Owner.
- B. Determine exact location of all electrical devices controlling mechanical equipment in cooperation with the Mechanical Contractor in the field before roughing-in.

* END OF SECTION 16480 *

SECTION 16720 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. The existing building is protected by a complete fire alarm system. Modify and extend the existing fire alarm system as required to coordination with new construction and remodeling.
- B. Provide new initiating devices, and other accessories as shown on drawings and as required.

1.3 SUBMITTALS

- A. Provide submittals for the Fire Alarm System in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the Contract Documents and the above referenced standards.
- B. Provide manufacturer's standard catalog literature for all new Fire Alarm System Devices.
- C. Provide two copies of the Fire Alarm System Shop Drawing Submittals, in addition to the quantity of submittals required by the General Conditions, for review by the local Authority Having Jurisdiction (AHJ).
 - 1. Approval of the AHJ is required prior to installing any part of the Fire Alarm

PART 2 - PRODUCTS

2.1 CONTROL PANEL

- A. Existing Simplex 4020 main fire alarm control panel is to remain.
 - 1. Provide new zone modules, control relays, etc., as required to control new fire alarm system initiating devices and control devices.
 - 2. Modify the main fire alarm control programming to properly annunciate and control new fire alarm system devices.
- B. Provide additional power supplies and/or batteries as required to operate the system with additional smoke detectors, fan shut down relays, smoke damper relays, etc.
- C. Identify each new zone by specific location with neatly typed labels on the control panel and the building map.

2.2 FIRE ALARM DEVICES

- A. New detectors shall be listed for use with the existing fire alarm control panel.
- B. New detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base or the detectors. Each detectors shall be installed on a separate base. Removal of any detector head from the base shall cause a trouble signal to be sounded at the

main fire alarm control panel.

- C. Protect all existing fire alarm system devices which remain. Remove smoke detector heads during demolition or construction as required to prevent excessive dust accumulation in the detector head. Clean all existing detector head upon completion of the work.

2.3 DUCT SMOKE DETECTOR

- A. Provide new SimplexGrinnell duct mounted photoelectric smoke detectors with cabinet mounted alarm LED and duct sampling tubes where indicated on the drawings.
- B. Provide factory fabricated sampling tubes to extend the full width of the ducts.

2.4 FIRE SAFETY FUNCTION CONTROL RELAYS

- A. Provide new control relays with SPDT contacts rated 10 amps at 120 VAC and with 24 VDC coil to control fan shut down, etc., as shown on the drawings.
- B. Provide fan shut down control relays in separate enclosure adjacent to the starter enclosure, or within the enclosure, of each air supply fan as shown on drawings and connect to a normally closed auxiliary contact in the fire alarm control panel. Connect the fan control circuit to the control relay output contacts so that the air supply fan will shut down upon general fire alarm.

2.5 WIRING

- A. Furnish and install new copper wire for all fire alarm system wiring of the sizes indicated on the drawings. Install all wiring in minimum 3/4" trade diameter metal raceway system as specified for power wiring.
- B. Wire for Initiating Devices Circuits shall be #14 AWG, Type THHN/THWN, or as directed by the fire alarm system manufacturer's representative.
- C. Wire for Fire Safety Function Circuits shall be minimum #14 AWG, Type THHN/THWN.
- D. Do not install fire alarm system wiring in raceways with any other wiring systems.

2.6 SYSTEM OPERATION

- A. The existing fire alarm system operation is as follows: Activation of any initiating device will cause all notification appliances to operate, shut down all air handling fans, close all smoke dampers, release all door holders, and transmit alarm signal to the central fire station. Alarm signals may be reset or silenced by authorized personnel only by entering a locked control cabinet and operating the proper silencing switch.
- B. Wire and program all new fire alarm system devices to be compatible with the existing system operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all raceways for initiating device circuits and notification appliance circuits with separate raceways entering and leaving each outlet box and/or enclosure.
 - 1. Wire the fire alarm system initiating device circuits in a Class A loop in accordance with NFPA 72-2002.

- B. Color code fire alarm system wiring as recommended by the manufacturer to match the existing fire alarm system color coding. Tag all conductors according to zone circuit at all terminals, pull and junction boxes.
- C. Paint all fire alarm system junction boxes, pull boxes, etc. red with identification of zones served indicated on the device or box.
- D. Supervision of installation, final connections, programming and testing will be provided by a trained factory representative of the existing fire alarm system manufacturer.
 - 1. Contact: SimplexGrinnell, Las Vegas District Office
1110 Palms Airport Drive
Las Vegas, Nevada 89119
Phone: (702) 739-1921
Fax: (702) 736-6521

3.2 SYSTEM OUTAGES

- A. The existing Fire Alarm System will remain completely operational throughout construction except portions may be temporarily taken out of service for reconnections as indicated on the drawings.
 - 1. Submit requests for fire alarm system outages to the Project Engineer and/or Owner not less than 7 day prior to any proposed fire alarm outages.
 - 2. Immediately notify the Building Facilities Manager and the Owner if the fire alarm is unintentionally disabled and immediately make repairs to restore the system to an operational condition.
 - 3. The contractor shall maintain a fire watch during all fire alarm system outages in accordance with International Fire Code Section 901.7.
 - 4. Do not leave any portion of the fire alarm system inoperable longer than is absolutely necessary to make reconnections.
 - 5. Provide temporary wiring and/or connections as required to maintain the system in an operable condition.

3.3 RECORD DRAWINGS

- A. Provide new building map for the existing control panel to reflect floor plan changes, new initiating devices locations and new initiating devices address numbering. Mount the building map behind a protective plastic covering.
- B. Update existing fire alarm system record drawing to include locations and wiring of new devices and equipment as installed. Include junction and pull box locations.

3.4 TESTS

- A. At the time of the final inspection, test each new and/or modified zone to show that all equipment is in proper working order.
 - 1. Tests shall be conducted in the presence of the Authority Having Jurisdiction, Owner and Architect and/or Engineer.
- B. Provide two-way radios, canned smoke and a hair dryer (or other means to set off smoke and heat detectors).

- C. Test each detector of each modified zone and each new zone and open each zone to test the Class A loops.
- D. All devices will be complete and operational.

3.5 TRAINING

- A. In addition to any detailed instructions called for, the Fire Alarm System Manufacturer's Representative must provide, without additional expense to the Owner, competent instruction to train campus personnel who will be in charge of the system, in the care and operation of the modified portions of the system. Instruction date will be set at time of final inspection.

* END OF SECTION 16720 *